Contract No. 68-W-98-210

RAC II

Revised Final Work Plan
Volume I

Cidra Groundwater Contamination Site
Remedial Investigation/feasibility Study
Cidra, Puerto Rico
Work Assignment No. 168-RICO-02WE

Remedial Response, Enforcement Oversight and Non-time Critical Removal Activities at Sites of Release or Threatened Release of Hazardous Substances in EPA Region II

CDM

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RESPONSE ACTION CONTRACT
FOR REMEDIAL RESPONSE, ENFORCEMENT OVERSIGHT,
CRITICAL REMOVAL ACTIVITIES AT SITES OF RELEASE OR
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Section 1 Introduction

CDM Federal Programs Corporation (CDM) received Work Assignment 168-RICO-02WE under the Response Action Contract (RAC) II to perform a Remedial Investigation/Feasibility Study (RI/FS) for the United States Environmental Protection Agency, Region II (EPA) at the Cidra Groundwater Contamination site (the Cidra site) located in Cidra, Puerto Rico. The purpose of this work assignment is to evaluate the nature and extent of groundwater, soil, surface water, and sediment contamination, identify potential contaminant sources through soil and groundwater investigations, and then determine the appropriate remedial alternatives for the identified contamination.

For presentation purposes, work plan figures and tables are presented at the end of Volume I.

1.1 Overview of the Problem

The overview of the Cidra site is summarized from the Hazard Ranking System (HRS) package prepared by Weston Solutions, Inc. (EPA 2003b). Additional site history and background information are included in Section 2.

The Cidra site, located in Cidra, Puerto Rico, consists of a groundwater plume with no currently identified source(s) of contamination. Figure 1-1 is the Site Location Map and Figure 1-2 is the Site Map. Puerto Rico Department of Health (PRDOH) ordered the following four public supply wells in Cidra to be closed due to contamination by tetrachloroethylene (PCE): Cidra Well 4 (Calle Padilla Final) in March 1996; Cidra Well 8 (Frente Cementerio) in October 1996; Cidra Well 3 (Planta Alcantarillado) in February 1999; and Cidra Well 6 (Calle Baldorioty) in August 2000. Other chlorinated volatile organic compounds (VOCs), including 1,1-dichloroethylene (1,1-DCE) and trichloroethylene (TCE), were also detected in the wells before they were closed.

In January and February 2003, the Region 2 Site Assessment Team (SAT) investigated 12 industrial sites around the Cidra area that could be potential sources of groundwater contamination. SAT used field screening technology and laboratory confirmatory analyses of soil samples. Contamination was not documented from surface soils through the intervening soil layers to the groundwater at any of these potential sources. Based on these results, there is insufficient information to conclusively determine the source of contamination of the local public supply wells.

1.2 Approach to the Development of the Work Plan

CDM reviewed all available information on the Cidra site prior to formulating the scope of work presented in this work plan. Section 8 provides a list of all documents reviewed and referenced during development of the work plan. The RI/FS for the site will include a RI, risk assessments (RAs), and a FS.

The RI will focus on collecting adequate data from appropriate media to characterize the nature and extent of contamination. Because no source of contamination has been identified at the Cidra site, the RI also will also investigate potential contaminant sources in the vicinity of the site. The sampling approach is discussed in Section 5. A Quality Assurance Project Plan (QAPP) detailing sample and analytical requirements for the field investigation and a health and safety plan (HSP) will be submitted separately. The RI report will provide a complete evaluation of sampling results.

The RAs for the Cidra site will evaluate the risk from exposure to contaminated media, including groundwater, soil, surface water, and sediment. The human health RA (HHRA) will be conducted according to EPA's *Risk Assessment Guidance for Superfund* (Part A 1989a and Part D 1998a) or according to the most recent EPA guidance and requirements. The screening level ecological risk assessment (SLERA) will be conducted according to EPA's *Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Risk Assessments* (ERAGS) (EPA 1997c) or according to the most current EPA guidance and requirements. The risk assessments will include a list of contaminants of potential concern (COPCs); toxicology of COPCs; transport, degradation, and fate analysis of COPCs; comparison of COPCs to applicable or relevant and appropriate requirements (ARARs); and determination of potential risk.

An FS will be completed in accordance with EPA guidance under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) "Interim Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988), or the most recent EPA FS guidance document. The FS will develop and screen remedial alternatives and provide detailed analysis of selected alternatives, including the "No Action" alternative. The remedial alternatives will be evaluated against the nine criteria required by EPA guidance documents: (1) overall protection of human health and the environment; (2) compliance with ARARs; (3) long term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume through treatment; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state acceptance; and (9) community acceptance.

1.3 Work Plan Content

This work plan contains nine sections, as described below.

Section 1	Introduction - The introductory section lays out the format of the work plan.
Section 2	Site Background and Setting - This section describes the site background, including the current understanding of the location, history, and existing conditions at the site.
Section 3	Initial Evaluation - This section presents the initial evaluation of existing data; it includes a description of previous sampling results, site geology and hydrogeology, the current conceptual site model (CSM), and a preliminary identification of ARARs.

Section 4	Work Plan Rationale - This section includes the Data Quality Objectives (DQOs) for the RI sampling activities and the approach for preparing the work plan to satisfy the DQOs.
Section 5	Task Plans - This section presents a discussion of each task of the RI/FS in accordance with the Cidra site RAC II Statement of Work (SOW) and discussions with EPA.
Section 6	Schedule - The project schedule is presented in this section.
Section 7	Project Management Approach - Project management considerations that define relationships and responsibilities for selected task and project management teams are described.
Section 8	References - The references used to develop material presented in this work plan are listed in this section.
Section 9	Glossary of Abbreviations - The acronyms and abbreviations used in the work plan are defined in this section.

Section 2
Site Background and Setting

2.1 Site Location and Description

The Cidra site is located in Cidra, Puerto Rico, and consists of portions of the Cidra commercial district and a groundwater plume with no identified source(s) of contamination (Figure 1-1). The plume covers approximately 6 acres (EPA 2003a).

The aquifer of concern at Cidra is in the Pre-Robles volcanic rock that underlies the area. Existing well logs and recent EPA subsurface investigations indicate that 9 to 120 feet of clay or silty clay and 10 to 30 feet of decomposed rock overlie the bedrock throughout the municipality of Cidra. Based on the existing well logs, water-bearing zones in the bedrock range from 40 to 360 feet below the ground surface (bgs) in a confined aquifer. The groundwater flow direction has not been determined and is expected to be complex due to the site's location between the Rio de la Plata and Rio de Bayamon drainages and the presence of Cidra Lake. The closed and active wells are finished in the bedrock aquifer at total depths ranging from 110 to 705 feet bgs, with surface casing lengths ranging from 8 to 224 feet (EPA 2003b).

Conservative estimates of the populations served when the wells were closed include 113 people by Cidra 3; 117 people by Cidra 4; 207 people by Cidra 6; and 0 people by Cidra 8. In total, there are 15 active drinking water wells located within 4 miles of the site, serving a total population of 8,838 people. There are 6,940 people who live within 2 miles of the site.

The topography and surface water drainage of the site is to the south/southwest toward Rio Arroyata, a tributary of Rio de la Plata. Limited surface water runoff from the most northern portion of the Cidra commercial district may flow northeast to the Lago de Cidra watershed. The 2-year, 24-hour rainfall for Cidra is about 5 inches, and the site is located outside the 500-year flood boundary.

A surface water intake located about 2.2 miles downstream of the possible groundwater discharge points in Lago de Cidra serves approximately 20,148 people. The surface water withdrawal is also used for watering commercial livestock. The lake is a popular fishing destination. Wetlands are not mapped in central Puerto Rico where Cidra is located; however, habitats for endangered and threatened species are documented along the surface water pathway and within a 4-mile radius of the site. There is a residential population of approximately 52,770 persons within 4 miles of the Cidra site.

2.2 Site History

The history of the Cidra site is summarized from the Expanded Site Inspection/ Remedial Investigation Report (ESI) package prepared by Weston Solutions, Inc. (EPA 2003a).

The Cidra groundwater plume is located in Cidra, Puerto Rico. The site consists of portions of the Cidra commercial district and a groundwater plume with no identified source(s) of contamination. PRDOH ordered the following four public supply wells in Cidra to be closed due to PCE contamination (The VOCs found in each well during the 2002 sampling round by EPA are listed in Table 2-1):

- Cidra Well 4 (Calle Padilla Final) in March 1996
- Cidra Well 8 (Frente Cementerio) in October 1996
- Cidra Well 3 (Planta Alcantarillado) in February 1999
- Cidra Well 6 (Calle Baldorioty) in August 2000

Other chlorinated VOCs, including 1,1-DCE and TCE, were also detected in the wells before they were closed.

In June 2002, EPA Region 2 SAT collected groundwater samples from the closed municipal supply wells and 20 other active and inactive wells in Cidra. The groundwater sample locations are shown in Figure 2-1. PCE was detected in the closed wells at concentrations ranging from 0.64 to 12 micrograms per liter (μg/L). PCE was also detected in two industrial/potable supply wells (IVAX No.1 and No.2) and three industrial wells (Glaxo Smith Kline No.1 and No.2 and Millipore - Cidra). The Glaxo Smith Kline wells and Millipore-Cidra industrial wells are located east of Lago de Cidra and are likely not associated with the VOC source that has impacted the closed public supply wells. Related chlorinated solvents, including 1,1-DCE; 1,1-dichloroethane (1,1-DCA); cis-1,2-dichloroethylene (cis-1,2-DCE); carbon tetrachloride; and TCE, were also detected in groundwater samples (Table 2-1). Maximum Contaminant Levels (MCLs) for PCE (5 μg/L) and 1,1-DCE (7 μg/L) were exceeded; however, the exceedances did not occur in active drinking water wells. Other VOCs were also detected, in most cases at estimated concentrations below the sample quantitation limits (SQLs).

The groundwater samples were also analyzed for semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and inorganic parameters. There were no detections of SVOCs, pesticides, or PCBs above SQLs. Inorganic parameters were not detected above MCLs in the groundwater samples, except thallium, which was reported at estimated concentrations above the MCL (2 μg/L) in three samples. Thallium is not known to be associated with the Cidra groundwater plume.

In January and February 2003, Region 2 SAT investigated 12 industrial sites in the Cidra area as potential sources of contamination for the groundwater plume. Eleven of the sites are listed in EPA's Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Hazardous Waste Sites database, and one site is listed in the Archived Sites database. They are:

■ International Dry Cleaners	PRN000204340
■ Shellfoam Products (archived)	PRD987377264
■ SmithKlein Beecham Pharmaceuticals, Inc.	PRD090023250

■	Tech Group de Puerto Rico, Inc.	PRN000204348
■	Zenith Laboratories Caribe, Inc.	PRD987377702
■	Excellent Laundry	PRN000204338
■	Creative Medical Corp.	PRN000204336
■	CMM Laundry	PRN000204330
■	Cidra Metal Caskets	PRN000204335
■	Cidra Convention Center	PRN000204333
■	CCL Label de Puerto Rico	PRN000204329
■	Caribbean Manufacturing Co.	PRN000204331

Region 2 SAT used direct-push technology to complete soil borings at the 12 industrial sites plus two background sites. Soil cores (and in one case, a groundwater sample at the Tech Group Puerto Rico (TGP) site) were retrieved from each borehole at 5-foot intervals to refusal, generally between 40 and 60 feet below ground surface and above the water table. The soil cores and one groundwater sample were screened for VOCs with the HAPSITE® Headspace Sampling System. Figure 2-2 shows the locations of the sites investigated by Region 2 SAT. Figures showing the soil boring locations at these facilities are located in Appendix A.

The field-screening results indicated the presence of PCE, TCE, and trans-1,2-dichloroethylene (trans-1,2-DCE) in soils collected from the International Dry Cleaners (INT) site. The samples with detected solvents were collected from depths of two to seven feet bgs at the INT site. The field-screening results indicated concentrations of PCE, TCE, and trans-1,2-DCE ranging from approximately 7 to 255 parts per billion (ppb), with the highest readings in a 4-foot-depth sample. Other detections included vinyl chloride in a sample from the Cidra Convention Center (CCC) site and 1,1,2,2-tetrachloroethane (1,1,2,2-TCA) in a sample from the TGP site, both at concentrations less than 3 ppb. The field-screening data retrieved from the HAPSITE® unit at the conclusion of field activities indicated the presence of other VOCs in soil samples from some sites, mostly at concentrations below 1 ppb, and chloroform in the groundwater sample collected from the TGP site.

Region 2 SAT used the screening results, particularly the PCE readings mentioned above, to select samples for VOC analysis through the Contract Laboratory Program (CLP). At sites where there were no detections, the CLP samples represent each borehole location and the full depth range of every five-foot interval to refusal.

The CLP analytical results confirm that PCE and related substances are present in soil at the INT site. PCE at 11,000 micrograms per kilogram (μg/kg); TCE at 2,800 μg/kg; and cis-1,2-DCE at 5,100 μg/kg were detected in the 4-foot sample. The same compounds were detected in the 7-foot sample at lower concentrations, while only cis-1,2-DCE at 6,700 μg/kg was detected in the 2-foot sample. The levels of PCE, TCE, and cis-1,2-DCE exceed EPA's generic migration-to-groundwater Soil Screening Levels (SSL). The only other significant concentrations were 1,1-DCE above the generic SSL in a soil sample from the Zenith Laboratories (ZEN) site, and an estimated concentration for 2-butanone in a sample from the Caribbean Manufacturing Co.

(CMC) site. The results also confirmed the presence of chloroform in the groundwater sample from the TGP site.

The soil sampling results from the seven remaining facilities showed no detections above background. EPA recommended no further action for these facilities in the HRS Package (EPA, 2003b).

Region 2 SAT collected two sediment samples from drainage channels at Cidra Industrial Park. VOCs were not detected in the drainage channel samples. Region 2 SAT also collected surface water and sediment samples from five locations in Cidra Lake (Lago de Cidra) to evaluate the interconnection between the lake and the groundwater plume. Field-screening and CLP analytical results indicated that there were no VOCs detected in the lake surface water and sediment samples.

2.2.1 Previous Investigations

Two previous investigations have been conducted at the site to identify the source of the groundwater contamination. Investigations and activities were performed by EPA.

2.2.1.1 Pre-CERCLIS Screening, EPA

In October 2000, EPA completed a Pre-CERCLIS Screening Report identifying sites in Cidra for further evaluation under CERCLA. In support of the evaluation, EPA personnel conducted file searches, interviews, and field reconnaissance surveys at 31 sites. Twenty-one sites were recommended for entry into CERCLIS.

2.2.1.2 Expanded Site Investigation/Remedial Investigation, Region 2 SAT

EPA's Region 2 SAT conducted an Expanded Site Investigation/Remedial Investigation of the Cidra site, which is summarized in Section 2.2.

2.3 Current Conditions

Currently the Cidra site is comprised of the VOC plume area which includes the four closed Puerto Rico Aqueduct and Sewer Authority (PRASA) public supply wells and two IVAX/Zenith supply wells. The site also encompasses nine potential source facilities within this plume which are located either in the densely populated Cidra commercial district, along the Route 171 corridor south of the commercial center or in the Cidra Industrial Park to the southeast. A vegetated drainage area and a cemetery are included in the site boundaries (Figure 1-2).

The Cidra commercial center includes stores, residences, municipal buildings, the town plaza, and three potential source areas including International Dry Cleaners (currently active), Former Excellent Dry Cleaners (currently a clothing store), and an Unnamed Former Dry Cleaners (currently a surf shop). The Route 171 corridor includes two schools, residences, a police station, a supermarket, and two potential source areas including an Esso gas station and the machine shop adjacent to the Esso gas station. The Cidra Industrial Park to the southeast includes numerous warehouses, active manufacturing facilities, includes four potential source areas (CCL Label, Cidra Convention Center, IVAX/Zenith Facility, and Pepsi).

Section 3
Initial Evaluation

This section presents an initial evaluation of site conditions, and is based on information obtained from previous investigations, published geological research documents, local and regional geological data, and data publicly available on the internet.

3.1 Review of Existing Data

This section summarizes the physical characteristics of the study area including the topography, drainage and surface water characteristics, regional and site-specific geology and hydrogeology, climate, population, and land use. Geological and hydrogeological data and publications pertaining to the Cidra, Puerto Rico Municipality were reviewed. Documents were obtained from the United States Geological Survey (USGS), USEPA, municipal data, and internet sources.

3.1.1 Topography

The Cidra municipality is located in the central-east section of Puerto Rico in the northern foothills of the Cordillera Central Mountain Range (Figure 3-1). The irregular topography has been shaped by volcanism and uplift from the collision of the Caribbean Tectonic Plate with the North American Tectonic Plate and erosion. Several major drainages are prevalent in the municipality and flow either southwest toward the Rio de la Plata drainage area or northeast toward Lago de Cidra and the Rio de Bayamon drainage area.

The Cidra site is located in the area surrounding the commercial district of the Cidra Municipality and includes the Cidra Industrial Park to the southeast. The topography in the vicinity of the Cidra site wells slopes south from the commercial area to an east-west drainage that crosses Route 171 south of the Cidra Cemetery (Figure 3-2). The topography in the vicinity of the industrial park slopes gently toward the west along this same drainage. This drainage eventually empties into the Rio Arroyata, a tributary of Rio de la Plata. The commercial area lies at an elevation of 1,400 feet above mean sea level (msl). Rio Arroyata forms a topographic low to the south at approximately 1,310 feet above msl. The elevation of the industrial park area is at approximately 1,345 feet above msl.

3.1.2 Drainage and Surface Water

The commercial center of the Cidra Municipality is at the surface water drainage divide between Rio de la Plata and Rio de Bayamon (Figure 3-3). Both are major rivers of Puerto Rico which flow north into the Atlantic Ocean, approximately 20 miles north of the site. The site, which includes a large portion of the commercial area and the industrial park to the southeast, drains to the south and west toward Rio Arroyata, a tributary of Rio de la Plata. Lago de Cidra, a manmade reservoir, is located 0.5 mile to the east of the Cidra site and commercial district and is within the Rio de Bayamon drainage basin. Some portions north and east of the commercial center may drain into Lago de Cidra. The site visit revealed that surface water drainage from identified potential sources within the Cidra site vicinity drain toward Rio Arroyata and Rio de la Plata and not toward Lago de Cidra.

3.1.3 Geological and Hydrogeological Characteristics

The geological and hydrogeological characteristics of the Cidra area are described in the following sections. The Municipality of Cidra is located on the divide between two major river basins, Rio de la Plata and Rio de Bayamon. The only significant aquifer beneath the site is in the fractured Cretaceous-age Pre-Robles volcanic bedrock. Complex groundwater flow is anticipated due to the presence of fracture flow in the bedrock aquifer and the site's location between two major river basins.

3.1.3.1 Regional and Site Geology

The Cidra site is located in the central-eastern section of Puerto Rico. The two strata encountered at the site are the Quarternary-age terrace deposits composed of silt, clay and decomposed rock and the underlying the Cretaceous-age Pre-Robles volcanic rock described as "Formation J" on the USGS Comerio Quadrangle geologic map (Pease and Briggs 1960) (Figure 3-4). Other units near the site vicinity but are not anticipated to be encountered during field investigations are the metamorphic hydrothermally-altered rocks to the southeast and the intrusive igneous hornblende diorite to the west/northwest (Figure 3-4). The two units expected to be found beneath the site are described below.

Quaternary Upper Silty Clay

The upper silty clay unit consists of 17 to 140 feet of reddish brown silty clay grading to gray and brown silty clay overlying decomposed weathered bedrock. The clay, silt, and decomposed rock is underlain by the Pre-Robles volcanic rock. In the Cidra area the contact between the upper silty clay unit and lower bedrock unit is approximately 80 feet bgs.

Pre-Robles Volcanic Rock

The lithology of the Pre-Robles Rock is variable, consisting of massive and thick bedded andesite and dacite submarine pyroclastic breccias with intercalated lavas, tuffs, and limestone (Glover 1971). The upper and middle parts of the Pre-Robles rocks were described by Glover (1971) as coarse near-vent pyroclastic breccias, deposited in a marine environment while the lower part of the sequence was described as near- and distant-vent submarine ash-fall and pyrocalstic flow deposits. Well data and logs obtained from PRASA, USGS, and well owners/operators indicate that active and inactive wells are completed in the rock formation, described in the well logs mainly as blue, brown, or black volcanic rock (EPA 2003a).

Numerous structural features exist in the vicinity of the Cidra site (Pease and Briggs 1960). The Arroyata Fault is located 0.25 mile to the south of the commercial area and adjacent to the industrial park, while the Arenas Anticline is located approximately 1.5 miles to the southeast of the commercial area. Numerous smaller faults are present throughout the Cidra site vicinity. The general strike of the faults and structural features is northwest to southeast.

3.1.3.2 Regional Hydrogeology

Groundwater generally occurs in the fractured consolidated volcanic rocks in the Cidra area, with precipitation as the primary source of groundwater recharge. Precipitation percolates through the ground to the zone of saturation or water table. Water moves in consolidated rock through joints and fractures, since the rocks have little primary porosity. The porosity of bedrock is only two to three percent, but fractures can considerably enhance groundwater flow.

Bedrock yields generally small to moderate quantities of water. Well yield in bedrock is determined by the type of bedrock, type of overlying unconsolidated deposits, and bedrock joints, fractures, and faults. Well yields in the fractured volcanic rock in the Cidra vicinity are generally from five to ten gallons per minute (gpm) or less (Miller et al. 1997). The highest well yields in the Cidra area are usually found in wells located in valleys and the lowest well yields in wells in the higher hills. The most productive wells in bedrock are located in valleys where joints, fractures, and other openings are numerous and recharge to bedrock is facilitated by topography and permeable overlying unconsolidated deposits.

3.1.3.3 Site-Specific Hydrogeology

The Cidra site encompasses a small plateau where the commercial center is located, a drainage area to the south of town where the closed municipal wells are located, and a valley below where the Cidra Industrial Park is located (Figure 3-2). The site is underlain by varying thicknesses of clay, silt, weathered bedrock, and fractured Pre-Robles Formation volcanic rock.

The aquifer of concern in the Cidra area is the Pre-Robles volcanic rock that underlies the region. Well data and logs obtained from PRASA, USGS, and well owners/operators indicate that active and inactive wells in Cidra are completed in the rock formation, described in well logs mainly as blue, brown, or black volcanic rock. Closed and active wells throughout Cidra range in total depth from 110 to 705 feet bgs, with surface casing lengths ranging from 8 to 224 feet.

During the subsurface investigations with direct-push technology, Region II SAT drilled through 17 to 73 feet of clay, silty clay, silt, and weathered bedrock before encountering equipment refusal. Compact material and an increase in weathered bedrock in the deeper intervals might be an indication of the proximity of the bedrock surface. Region II SAT's field investigation results correspond with existing data, which indicate that 9 to 120 feet of clay and 10 to 56 feet of decomposed rock overlie the volcanic bedrock throughout the municipality of Cidra (EPA 2003a).

Based on well logs, water-bearing zones in the bedrock range from 40 to 360 feet bgs. Well log Information from the closed PRASA supply well Cidra No. 6, indicates that clay is from 0 to 25 feet bgs, decomposed rock from 25 to 81 feet bgs, and volcanic rock at 81 feet. Static groundwater is at 98 feet bgs. A drawdown of 47 feet was measured while pumping the well at 250 gpm. In the Cidra Industrial Park area to the southeast the well drilled at the Pepsi facility shows that clay is from 0 to 120 feet bgs, decomposed rock from 120 to 140 feet, blue volcanic rock with some brown lenses from 140 to 229 feet bgs and black volcanic rock with some green lenses from 229 to 465 feet bgs. Static groundwater level is at 111 feet bgs. A drawdown of 83 feet was measured while pumping the well at 60 gpm. Figure 3-2 shows the location of the supply well Cidra No. 6 and the Pepsi facility.

Groundwater flow in the Cidra site vicinity is expected to be variable due to its location on the surface water and topographic divide between two of Puerto Rico's largest river systems, Rio de la Plata and Rio de Bayamon. Groundwater flow will be determined from measuring groundwater levels in existing wells and in proposed monitoring wells.

3.1.4 Climate

The climate for Cidra, which is located in the central-east section of Puerto Rico, is classified as tropical humid and is moderated by the nearly constant trade winds that originate in the northeast and its location in the foothills of the Cordillera Central Mountain Range. The average annual temperature for the Cidra area is 81.2 F. Precipitation data from 1971 to 2000 recorded at the Cidra 1 E rainfall station shows an annual precipitation of 60.5 inches as reported on the National Oceanic and Atmospheric Administration (NOAA) website - http://www.srh.noaa.gov/sju/pr_mean_annual_pcp.jpg.

CDM will obtain both historical and current climate data, including, but not limited to, temperature, precipitation, and wind speed and direction, from local meteorological stations. Climatic data will be collected during the course of the field investigation and will be incorporated in the RI report.

3.1.5 Population, Land Use and Hazardous Waste Sites

The Cidra site is located within the main commercial district of the Cidra Municipality in central eastern Puerto Rico. The Cidra Municipality is comprised of 36 square miles with a population of 42,753 and a population density of 1,184 people per square mile (2000 U.S. Census).

Land use characteristics for the Cidra site area includes forest (34 percent), agriculture/rural (49 percent), and urban (16 percent) (Ramos-Gines 1997). The land use in the vicinity of the site is primarily residential, commercial, manufacturing, and agricultural.

The population currently served by wells located within a four mile radius of the site that draw water from the Pre-Robles volcanic rock aquifer is 8,838 people (EPA 2003b).

Eleven sites in the Cidra site vicinity are listed in EPA's CERCLIS Hazardous Waste Sites database, and one site is listed in the Archived Sites database. The sites are listed in Section 2.2, Site History. No National Priority List (NPL) sites are located within four miles of the Cidra site.

3.1.6 Characteristics of Chemical Contaminants

The groundwater contamination is characterized by detections of PCE, TCE, cis-1,2-DCE, 1,1-DCE, carbon tetrachloride and 1,1-DCA, as discussed in previous sections of this work plan.

3.1.7 Conceptual Site Model

The CSM was developed based on information collected such as previous investigations and geology, hydrogeology, and hydrologic investigations. It will be updated to integrate the different types of information collected during a remedial investigation, including geology, hydrogeology, site background and setting, and the fate and transport of contaminants associated with the site. The CSM will be updated as information is obtained during the RI. Figure 3-5 shows the current CSM for the Cidra site.

Physical Setting with Respect to Groundwater Movement

The Cidra site is located within the Rio de la Plata drainage basin and just west of Lago de Cidra and Rio de Bayamon drainage basin. The geology of the area is characterized by silty clay at the surface, a layer of decomposed rock underlain by volcanic bedrock. The predominant bedrock in the Cidra area is the Pre-Robles Formation, which consists of volcanic breccias, tuffs, and ash flows. The bedrock has little primary porosity; secondary porosity such as fractures is common. Public supply wells tap the bedrock aquifer. Wells in the bedrock are cased to the top of the bedrock, with the bedrock portion completed either as an open hole or screened. The water table is generally between 40 and 110 feet bgs and the groundwater flow direction is currently unknown. If groundwater flows in the direction of topography and drainage as is generally the case, flow is expected to be south-southwest. However, groundwater flow in bedrock fractures can be complex. Groundwater may discharge to Rio Arroyata and its tributaries, which traverse the southern area of the site.

All of the groundwater in the Cidra area is derived from precipitation. The volume of water that percolates down to the water table and recharges the groundwater is the residual of the total precipitation not returned to the atmosphere by evapo-transpiration or lost by runoff to the surface water drainage systems.

Potential Contaminant Sources

The site consists of a groundwater plume with no identified source(s) of the contamination. Groundwater sampling at the site detected PCE in the closed PRASA public supply wells at concentrations ranging from 0.64 to 12 µg/L. PCE was also detected in two IVAX/Zenith supply wells. Related chlorinated solvents, including 1,1-DCE; 1,1-DCA; cis-1,2-DCE; carbon tetrachloride; and TCE, were also detected in groundwater samples.

EPA has identified nine facilities as potential contaminant sources for the VOC groundwater contamination at the Cidra site. The facilities are: International Dry Cleaners, Former Excellent Dry Cleaners, Unnamed Former Dry Cleaners, CCL Label, Cidra Convention Center, IVAX/Zenith facility, Pepsi, Esso gas station on Route 171, and the machine shop adjacent to the Esso gas station (Figure 3-6 and Table 3-1).

Four of these facilities, International Dry Cleaners, CCL Label, Cidra Convention Center, and IVAX/Zenith Facility were investigated by EPA for potential VOC contamination in soils. The only facility where significant VOC contamination was detected in soils was International Dry Cleaners, located in the commercial center of Cidra. Low levels of VOC soil contamination were detected at Cidra Convention Center and IVAX/Zentih Facility (Table 3-1). CCL Label remains a possible source due to evidence of past VOC usage at the facility. The remaining five facilities have not been investigated by EPA but their proximity to the groundwater plume and their potential use of VOCs make them potential sources for further investigation. The five facilities are: Former Excellent Dry Cleaners, Unnamed Former Dry Cleaners, Pepsi, Esso gas station on Route 171, and the machine shop adjacent to the Esso gas station.

Caribbean Manufacturing was listed as one of the five sites in the EPA HRS Report (EPA 2003b) for further investigation. The facility is located a mile north of the Cidra commercial district, in the Lago de Cidra Watershed. This facility will not be part of the PRP source investigation because of it's distance from the actual groundwater contamination which is located south of the Cidra commercial district. If evidence arises during the Cidra RI that implicates this facility it may be investigated at a later date.

Expected Transport and Fate of Site Contaminants

Groundwater

Liquid chlorinated solvents such as PCE and TCE, discharged to the ground surface would migrate downward through the unsaturated zone in a relatively linear pattern, with minimal dispersion from the discharge location. However, since clays are present at the potential source areas, migration of the liquid solvents could be complicated. Discharged solvents would migrate downward to the top of the clay unit, pool, then begin to migrate across the surface of the clay until a gap in the clay is encountered and then migrate through the decomposed bedrock and into the fractured bedrock and finally to the groundwater table. The unsaturated zone is approximately 40 to 110 feet thick in the Cidra site area.

Once the liquid chlorinated solvents, such as PCE and TCE, encounter the water table, some of the solvent would dissolve into the groundwater and begin to move in the direction of groundwater flow. Since the aquifer is fractured volcanic bedrock, the direction of the dissolved phase is expected to be complex because of fracture flow. If the quantity of solvent reaching the water table is sufficient, some of the solvent may remain in an undissolved state as a dense non-aqueous phase liquid (DNAPL). Since PCE and TCE are denser than water, the solvent would continue to move downward through fractures under the influence of gravity. DNAPL would sink until it encountered a lower permeability zone, such as low permeability or dead end fractures, which would slow or stop the downward migration. DNAPL could pool or accumulate within these fractures and remain stationary. Movement of DNAPL in the saturated zone can be very complex, with movement controlled by the permeability of fracture zones and fracture orientation.

Chlorinated solvents such as PCE and TCE in a dissolved phase move with the groundwater flow, but generally at a slower rate than groundwater. The full extent of contamination in the aquifer is currently unknown.

Natural attenuation of chlorinated solvents is a documented process, with PCE breaking down through a known decay chain of compounds, with daughter products including TCE, cis-1,2-DCE and vinyl chloride (Vogel et al 1987). Breakdown of chlorinated solvents occurs most prominently under anaerobic conditions. It is currently unknown if the bedrock aquifer is aerobic or anaerobic.

Air

PCE and TCE are volatile organic chemicals. As such, they volatilize to the atmosphere and, in the unsaturated soil zone, to the pore spaces between soil particles. Volatile chemicals dissolved in groundwater also volatilize into the overlying unsaturated zone as a plume moves downgradient with the groundwater flow. Vapors move through the unsaturated zone pore spaces, often seeking preferential flow pathways such as sandier zones with more porosity and permeability, gravel commonly placed beneath concrete basements, or pipelines that may be backfilled with sandy material. As vapors move through the unsaturated zone, they can enter structures, such as homes, affecting air quality. Vapor movement may also be affected by differential pressure gradients, either natural (e.g., caused by weather changes) or man-made (e.g., pressure differences inside and outside structures).

Surface Water/Sediment

Groundwater may discharge into surface water bodies, including Rio Arroyata Lago de Cidra, and several other smaller streams. Therefore, the potential exists for contamination from the groundwater to affect the quality of surface water and/or sediments at (or downgradient from) the discharge points. Contaminated surface water and/or sediment could result in exposure to people utilizing the river or streams, or to ecological resources such as aquatic organisms or animals that frequent the habitat at the edge of water bodies. In addition, chemicals could enter the food chain, resulting in ecological exposure to higher levels of the food chain.

3.2 Preliminary Identification of Applicable or Relevant and Appropriate Requirements

This section provides a preliminary determination of the regulations that are applicable or relevant and appropriate to remediation of the groundwater, soil, surface water, and sediment media at the Cidra site. Both federal and state environmental and public health requirements are considered. In addition, this section identifies federal and Commonwealth criteria, advisories, and guidances that could be used to evaluate remedial alternatives. Only those regulations that are considered relevant to the site are presented.

3.2.1 Definition of ARARs

The legal requirements that are relevant to the remediation of the site are identified and discussed using the framework and terminology of CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA). These acts specify that Superfund remedial actions must comply with the requirements and standards of both federal and Commonwealth environmental laws.

The EPA defines applicable requirements as "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or Commonwealth environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site". An applicable requirement must directly and fully address the situation at the site.

The EPA defines relevant and appropriate requirements as "those cleanup standards, standards of control, or other substantive requirements, criteria, or limitations promulgated under federal environmental or Commonwealth environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site".

Remedial actions must comply with Commonwealth ARARs that are more stringent than federal ARARs. Commonwealth ARARs are also used in the absence of a federal ARAR, or where a Commonwealth ARAR is broader in scope than the federal ARAR. In order to qualify as an ARAR, Commonwealth requirements must be promulgated and identified in a timely manner. Furthermore, for a Commonwealth requirement to be a potential ARAR it must be applicable to all remedial situations described in the requirement, not just CERCLA sites.

ARARs are not currently available for every chemical, location, or action that may be encountered. For example, there are currently no ARARs which specify clean-up levels for sediments. When ARARs are not available, remediation goals may be based upon other federal or Commonwealth criteria, advisories and guidance, or local ordinances. In the development of remedial action alternatives the information derived from these sources is termed "To Be Considered" (TBC) and the resulting requirements are referred to as TBCs. EPA guidance allows clean-up goals to be based upon non-promulgated criteria and advisories such as reference doses when ARARs do not exist, or when an ARAR alone would not be sufficiently protective in the given circumstance.

By contrast, there are six conditions under which compliance with ARARs may be waived. Remedial actions performed under Superfund authority must comply with ARARS except in the following circumstances: (1) the remedial action is an interim measure or a portion of the total remedy which will attain the standard upon completion; (2) compliance with the requirement could result in greater risk to human health and the environment than alternative options; (3) compliance is technically impractical from an engineering perspective; (4) the remedial action will attain an equivalent standard of performance; (5) the requirement has been promulgated by the Commonwealth, but has not been consistently applied in similar circumstances; or (6) the remedial action would disrupt fund balancing.

ARARs and TBCs are classified as chemical, action, or location specific. Descriptions of these classifications are provided below:

- Chemical-specific ARARs or TBCs are usually health or risk-based numerical values, or methodologies which when applied to site specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.

- Location-specific ARARs or TBCs generally are restrictions imposed when remedial activities are performed in an environmentally sensitive area or special location. Some examples of special locations include flood plains, wetlands, historic places, and sensitive ecosystems or habitats.

- Action-specific ARARs or TBCs are restrictions placed on particular treatment or disposal technologies. Examples of action-specific ARARs are effluent discharge limits and hazardous waste manifest requirements.

3.2.2 Preliminary Identification of ARARs and TBCs

The identification of ARARs occurs at various points during the RI/FS and throughout the remedial process. ARARs are used to determine the extent of cleanup, to scope and formulate remedial action alternatives, and to govern the implementation of the selected alternative.

The following are preliminary ARARs that may impact the selection of remedial alternatives for various environmental media at the site. This preliminary list of ARARs is based on current site knowledge and will be reviewed and updated during the RI/FS processes. Periodic review of the preliminary list of ARARs will assure that the ARARs remain applicable, as more site-specific information becomes available, and as new or revised ARARs are established.

3.2.2.1 Chemical-Specific ARARs

The determination of potential chemical-specific ARARs and TBCs for a site typically follows an examination of the nature and extent of contamination, potential migration pathways and release mechanisms for site contaminants, the presence of human receptor populations, and the likelihood that exposure to site contaminants will occur. The potential chemical-specific federal and Commonwealth ARARs for the site are as follows:

Federal:

- Resource Conservation and Recovery Act (RCRA) Groundwater Protection Standards and Maximum Concentration Limits (40 Code of Federal Regulations (CFR) 264, Subpart F)

- Clean Water Act, Water Quality Criteria (Section 304) (May 1, 1987 - Gold Book)

- Safe Drinking Water Act, Maximum Contaminant Levels (40 CFR 141.11-.16) issued July 1, 1991 and amended in the Federal Register 40 CFR Part 141 issued June 29, 1995. These levels include secondary MCLs, which are not enforceable but set standards for taste, odor, color, appearance, and other aesthetic factors that may affect public acceptance of water.

Commonwealth:

- Puerto Rico Water Quality Standards - Puerto Rico Environmental Quality Board (PREQB), Water Quality Standards Regulation, March 28, 2003).

- Puerto Rico Department of Health (PRDOH) National Primary Regulations of Potable Water, March 1992.

- PRDOH General Regulation for Environmental Health, Regulation No. 6090, February 4, 2000.

3.2.2.2 Location-Specific ARARs

The location of the site is a fundamental determinant of its impact of human health and the environment. Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in a specific location (EPA 1988). Some examples of these unique locations include: flood plains, wetlands, historic places, and sensitive ecosystems or habitats. The potentially applicable federal and Commonwealth location-specific ARARs for the site are as follows:

Federal:

- Executive Order on Wetlands Protection (CERCLA Wetlands Assessments) No. 11990.

- National Historic Preservation Act (16 United States Code [USC] 470) Section 106 *et seq.* (36 CFR 800)

- Endangered Species Act of 1973 (16 USC 1531) (Generally, 50 CFR Parts and 402)

- RCRA Location Requirements for 100-year flood plains (40 CFR 264.18(b)).

- Fish and Wildlife Coordination Act (16 USC 661 *et seq.*)
- Wetlands Construction and Management Procedures (40 CFR 6, Appendix A)
- Executive Order 11988, "Floodplain Management"
- Executive Order 11990, "Protection of Wetlands"
- 1985 Statement of Policy on Floodplains/Wetlands Assessments for CERCLA Action

Commonwealth:

- Puerto Rico EQB, Guidelines for Environmental Impact Statements
- Puerto Rico Department of Natural and Environmental Resources, Critical Element and Endangered Species Database, 1998

3.2.2.3 Action-Specific ARARs

Based on the identification of remedial response objectives and applicable general response actions, numerous federally promulgated action-specific ARARs and TBCs will affect the implementation of remedial measures and include administrative requirements related to treatment, storage and disposal actions.

The primary federal requirements which guide remediation are those established under CERCLA, as amended by SARA. The National Contingency Plan (NCP) incorporates the SARA Title III requirement that alternatives must satisfy ARARs and utilize technologies that will provide a permanent reduction in the toxicity, mobility or volume of wastes, to the extent practicable.

RCRA establishes both administrative (e.g., permitting, manifesting) requirements and substantive (i.e., design and operation) requirements for remedial actions. For all CERCLA actions conducted entirely onsite, only the substantive requirements apply. The potentially applicable federal and Commonwealth action-specific ARARs are as follows:

Federal:

- RCRA Subtitle C Hazardous Waste Treatment Facility Design and Operating Standards for Treatment and Disposal Systems, (i.e., landfill, incinerators, tanks, containers, etc.)(40 CFR 264 and 265) (Minimum Technology Requirements)
- RCRA Ground Water Monitoring and Protection Standards (40 CFR 264, Subpart F)

- RCRA Manifesting, Transport and Recordkeeping Requirements (40 CFR 262)
- RCRA Wastewater Treatment System Standards (40 CFR 264, Subpart X)
- RCRA Storage Requirements (40 CFR 264; 40 CFR 265, Subparts I and J)
- RCRA Subtitle D Nonhazardous Waste Management Standards (40 CFR 257)
- Toxic Substances Control Act (TSCA)(40 CFR 761)
- Clean Water Act - National Pollution Discharge Elimination System (NPDES) Permitting Requirements for Discharge of Treatment System Effluent (40 CFR 122-125)
- Clean Water Act Discharge to Publicly Owned Treatment Works (POTW) (40 CFR 403)
- National Emission Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR 61)
- Occupational Safety and Health Standards for Hazardous Responses and General Construction Activities (29 CFR 1904,1910,1926)
- Fish and Wildlife Coordination Act (16 UC 661 et seq.). (Requires actions to protect fish or wildlife when diverting, channeling or modifying a stream).
- National Primary and Secondary Ambient Air Quality Standards (40 CFR Part 50)
- The Endangered Species Act

Commonwealth:

- Puerto Rico General Requirements for Permitting Wells
- Puerto Rico EQB, regulation for the Control of Atmospheric Pollution, 1995
- Puerto Rico EQB, Regulation for the Control of Hazardous and Non-Hazardous Waste, 1982 as amended, 1985, 1986 and 1987
- Puerto Rico EQB, Underground Storage Tank Control Regulations, 1990
- Puerto Rico EQB, underground Injection Control Regulations, 1988

3.2.2.4 To Be Considered

When ARARs do not exist for a particular chemical or remedial activity, other criteria, advisories and guidance (TBCs) may be useful in designing and selecting a remedial alternative. The following criteria, advisories and guidance were developed by EPA, other federal agencies and Commonwealth agencies. The potentially applicable federal and Commonwealth TBCs are as follows:

Federal TBCs (Action, Location, and Chemical-Specific):

- Safe Drinking Water Act National Primary Drinking Water Regulations, Maximum Contaminant Level Goals (MCLGs)
- National Recommended Water Quality Criteria, EPA 2003
- Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario - Lowest Effect Level (LEL) and Severe Effects Level (SEL) (Ontario August 1993)
- EPA Region 9 Preliminary Remediation Goals (PRGs), (EPA 2002)
- EPA Drinking Water Health Advisories
- TSCA Health Data
- Policy for the Development of Water-Quality-Based Permit Limitations for Toxic Pollutants (49 Federal Register 8711)
- Ground Water Classification Guidelines
- Ground Water Protection Strategy
- Fish and Wildlife Coordination Act Advisories.
- Control of Air Emissions from Superfund Air Stripper at Superfund Groundwater Sites (OSWER Directive 9355.0-28)
- Draft Guidance for Evaluation of the Vapor Intrusion to Indoor Air Pathway, EPA 2002

Commonwealth TBCs (Action, Location, and Chemical-Specific):

- Puerto Rico EQB, Guidelines for Environmental Impact Statements
- PREQB, Soil Erosion Control and Sediment Prevention Regulation
- Puerto Rico EQB, Mixing Zone and Bioassay Guideline, 1988
- Puerto Rico Departmental of Natural and Environmental Resources, Critical Element and Endangered Species Database, 1998

Section 4
Work Plan Rationale

4.1 Data Quality Objectives

DQOs are qualitative and quantitative statements which specify the quality of data required to support decisions regarding remedial response activities. DQOs are based on the end uses of the data collected. The data quality and level of analytical documentation necessary for a given set of samples will vary, depending on the intended use of the data.

As part of the work plan scoping effort, site-specific remedial action objectives were developed. Sampling data will be required to evaluate whether or not remedial alternatives can meet the objectives. The intended uses of these data dictate the data confidence levels. The guidance document *Guidance for the Data Quality Objectives Process* (EPA 2000) was used to determine the appropriate analytical levels necessary to obtain the required confidence levels. The three levels are screening data with definitive level data confirmation, definitive level data, and field measurement-specific DQO requirements (Table 4-1).

The applicability of these levels of data will be further specified in the QAPP. Sampling and analytical data quality indicators (DQIs) such as precision, accuracy, representativeness, comparability, completeness, and sensitivity will also be defined in the QAPP.

4.2 Work Plan Approach

The HRS (EPA 2003b) indicates that the Cidra site consists of a "contaminated groundwater plume of unknown volume without an identified source". The Puerto Rico Department of Health (PRDOH) closed four municipal supply wells (Cidra 3, Cidra 4, Cidra 6, and Cidra 8) because they were contaminated with PCE, TCE and other VOCs. In June 2003 and early 2004, EPA conducted an Expanded Site Inspection (ESI) to determine the source or sources of contamination. The ESI included collection of groundwater samples from public supply wells, industrial wells, and inactive wells in the area, and collection of soil samples from 12 industrial sites in the area to investigate potential sources of groundwater contamination. The HRS concluded that the data do not "conclusively substantiate attribution of the groundwater contamination to any source" (EPA 2003b). Because of the lack of an identified source or sources of groundwater contamination and based on discussions with EPA at the technical scoping meeting held on December 13, 2005, the technical approach developed in this work plan has two primary objectives:

- Identify the source or sources of the groundwater contamination

- Define the nature and extent of contamination in site media including groundwater, soil, surface water, and sediments.

This work plan defines the field investigation activities that will provide data to meet these primary objectives. The field investigation activities also will provide adequate data to support preparation of technical memoranda, an RI report, an HHRA, a SLERA, an FS and a Record of Decision (ROD). The data will also be used to support EPA's efforts to identify potentially responsible parties (PRPs). Both screening-level and definitive-level data will be used to support the objectives of this RI/FS.

4.2.1 Development of the Technical Approach

A review of previously collected data indicates that significant data gaps exist in the understanding of the nature and extent of groundwater contamination and contaminant sources. Therefore the CSM, a significant element used to develop the field investigation, is very limited. CDM reviewed existing data provided by EPA's Site Assessment Branch including the HRS (EPA 2003b) and ESI Report (EPA 2003a) and background documents obtained from the USGS Caribbean Office, and other sources. Review of the available hydrogeologic and soil data indicates that there is limited or no information in the following areas:

- Source Areas - Information on contaminants present in potential industrial source areas and former and present dry cleaners
- Groundwater Flow - Lateral and vertical groundwater flow in the bedrock in the vicinity of the affected wells
- Stratigraphy - Depth and nature of overburden and bedrock including locations of water bearing zones, degree of fracturing, and fracture orientation
- Contamination - Nature and distribution of contamination within the aquifer
- Pumping Effects - Effects of local pumping on groundwater flow
- Groundwater/Surface Water Interaction - Relationship between groundwater and surface water (Lake Cidra and associated streams)

In order to define contamination and identify potential source areas, additional groundwater, hydrogeologic, and soil data is needed.

A key consideration in developing the field investigation for the Cidra Site is that a contaminant source has not been identified. Review of the available background information, including the HRS (EPA 2003b) and ESI (EPA 2003a) results, indicates a number of potential sources in the area including industrial properties to the southeast of the affected municipal wells and current and former dry cleaning establishments to the north of the affected municipal wells. The hydrogeological and soil investigation activities were designed to provide information to support identification of source areas in the site vicinity. Activities such as downhole geophysical logging and initial packer sampling were selected to provide information on the geometry and lithology of the bedrock aquifer, groundwater flow, and preliminary information on contaminant distribution (both vertical and horizontal) within the aquifer. Together with soil investigation activities and previous information, these data will support identification of potential contaminant sources while also providing information to define the nature and extent of contamination at the site.

CDM developed a technical approach and presented it to EPA in a technical scoping meeting held on December 13, 2005. The purpose of the technical scoping meeting was to present a preliminary technical approach and obtain input from EPA and stakeholders. A meeting minutes letter summarizing changes to the initial technical approach was prepared and submitted to EPA. Input from the technical scoping meeting is incorporated into this work plan.

4.2.2 Field Investigation Staging

Because of the limitations of the existing data and the lack of a defined source of contamination at the Cidra site, the field program will be performed in stages. A staged approach provides efficient use of resources by allowing data collected in one stage of the investigation to be used to focus and refine data collection activities in subsequent stages. It also provides flexibility to focus the investigation on potential source areas identified in the early stages of the investigation. This is particularly applicable for the Cidra site where existing hydrogeologic information is limited and the source of contamination has not been identified.

This work plan divides the field investigation activities into two major portions referred to as Stages I and II. The work plan structure has been modified to accommodate the sequential nature of the investigation. The primary focus of Stage I is identification of potential contaminant sources; however, the information is also expected to provide data that will be used to define the nature and extent of contamination. The Stage I hydrogeological investigation is further divided into two portions; Stage Ia and Stage Ib. Stage Ib includes installation of two contingent multiport wells, primarily to provide a means to confirm sources areas identified during the Stage 1a soil and hydrogeological investigations. The focus of Stage II is to fully define the nature and extent of contamination in site media, including sufficiently establishing contaminant boundaries to develop remedial alternatives and prepare a ROD. Thus, hydrogeological investigation activities are described in three separate sections of this work plan; Stage Ia, Stage Ib, and Stage II.

As discussed in the technical scoping meeting with EPA held on December 13, 2005, the soil investigation (defined in Section 5.3.4 of this work plan) and the Stage Ia hydrogeological investigation will be conducted concurrently.

Use of a staged approach requires some flexibility in development of the work plan and execution of the field investigation, largely because of uncertainties derived from a process that uses preliminary data to focus and refine subsequent investigation activities. Therefore, it was necessary to make some assumptions about the quantities for planned activities. For example, the number of ports required for a given multiport monitoring well depends on a number of factors including the final depth of the well, location of water bearing zones, and vertical distribution of contaminants obtained from packer sampling. Assumptions made for each stage of work are clearly defined in this work plan. The rationale and decisions required to determine the actual quantities are also defined for activities that depend on evaluation of data from previous activities.

The staged approach defined in this work plan also requires significant communication and coordination with the EPA Remedial Project Manager (RPM) and EPA technical specialists, particularly at decision points between stages. Therefore, this work plan identifies critical decision points in the process. Technical memoranda will be prepared by CDM and technical meetings will be held to facilitate decision . making required during the RI. The CDM SM will maintain regular communication with the EPA RPM throughout the field investigation.

The major field investigation activities, by stage, are defined below:

- Stage Ia Field Investigation
  - Existing monitoring well evaluation and sampling
  - Industrial facilities source area investigation
  - Current and former dry cleaners source area investigation
  - Borehole drilling and coring
  - Borehole logging
  - Packer sampling and packer testing
  - Groundwater elevation measurements (synoptic and long term)
  - Evaluation of Stage Ia field investigation data (decision point - technical meeting to define Stage Ib)

- Stage Ib Field Investigation
  - Borehole drilling and coring
  - Borehole logging
  - Packer sampling and packer testing
  - Multiport monitoring well installation and sampling
  - Evaluation of Stage I hydrogeologic data (decision point - technical memorandum defining stage II)

- Stage II Field Investigation
  - Borehole drilling and coring
  - Borehole logging
  - Packer sampling
  - Optional aquifer testing
  - Multiport monitoring well installation and sampling
  - Groundwater/surface water interaction evaluation
  - Surface water and sediment sampling
  - Ecological characterization

4.2.3 Anticipated Laboratory Analyses

RAC II field team personnel will collect environmental samples in accordance with the rationale described in Section 5.3 of this work plan. All standard EPA sample collection and handling techniques will be utilized. The Field and Analytical Services Teaming Advisory Committee (FASTAC) procedures will be followed. FASTAC procedures will be used to assign laboratories to analyze samples collected during this RI (see Section 5.4.2).

The following sample analyses are anticipated for the Cidra site:

- <u>Groundwater Packer Samples in Bedrock Boreholes</u>: Low detection limit (LDL) VOCs, with 24-hour turnaround for faxed results

- <u>Existing and Closed Supply Well Samples</u>: LDL VOCs, Target Compound List (TCL) SVOCs, pesticides/PCBs, Target Analyte List (TAL) inorganics, chloride, methane, ethane, ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, total organic carbon (TOC), total suspended solids (TSS), total dissolved solids (TDS), ammonia, hardness, and total Kjeldahl nitrogen (TKN)

- <u>Multiport Monitoring Well Samples</u>: LDL VOCs, TCL SVOCs, pesticides/ PCBs, TAL inorganics, chloride, methane, ethane, ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, TOC, TSS, TDS, ammonia, hardness, and TKN

- <u>Source Investigation Soil Samples</u>: Full TCL/TAL parameters for all samples. pH, TOC, and grain size (one-half of the samples)

- <u>Surface Water Samples</u>: Full TCL/TAL parameters (including LDL VOCs), alkalinity, ammonia, hardness, nitrate/nitrite, TKN, sulfate, sulfide, chloride, pH, TOC, TDS, and TSS

- <u>Sediment Samples</u>: Full TCL/TAL parameters, pH, TOC, and grain size

RAS CLP and DESA analytical results will be validated by EPA Region II. CDM will validate all subcontract laboratory data using the protocols specified in CDM's validation SOP which will be attached to the QAPP. CDM will then tabulate and evaluate the data and use it to characterize contamination at the site. All samples will be analyzed using the most current EPA-approved methods. Sampling procedures and specific analytical methods will be detailed in the site-specific QAPP.

Section 5
Task Plans

The tasks identified in this section correspond to EPA's SOW for the Cidra site, dated September 28, 2005. The tasks for the RI/FS presented below correspond to the applicable tasks presented in the *Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988). In addition, EPA's SOW includes a task for project close-out. The task presentation order and numbering sequence correspond to the work breakdown structure provided in EPA's SOW.

The scope of the field investigations for the RI/FS was discussed with EPA and other project stakeholders in a technical meeting on December 13, 2005. Field work will be conducted in two stages. Stage I will identify potential sources through soil and groundwater investigation and will support EPA's efforts to identify PRPs. Stage I will be further divided into Stage Ia, soil and packer sampling and Stage Ib, multiport well installation and groundwater sampling. Stage II will address data gaps from Stage I and will define the nature and extent of contamination at the Cidra site. Technical memoranda will be presented to EPA or meetings will be held with EPA after Stage Ia, Stage Ib, and Stage II (completion of RI field activities). Major elements of the field investigation are discussed in Section 5.3.

5.1 Task 1 - Project Planning and Support

The project planning task generally involves several subtasks that must be performed in order to develop the plans and the corresponding schedule necessary to execute the RI/FS. These subtasks include project administration, conducting a site visit, performing a review and detailed analysis of existing data, attending technical scoping meetings with EPA and other support agencies, preparing this RI/FS work plan, preparing the QAPP and HSP, and procuring and managing subcontractors.

5.1.1 Project Administration

The project administration activity involves regular duties performed by the CDM site manager (SM) and the Program Support Office throughout the duration of this work assignment. CDM will provide the following project administration support in the performance of this work assignment.

The SM will:

- Prepare the technical monthly report
- Review weekly financial reports
- Review and update the project schedule
- Attend quarterly internal RAC II meetings
- Communicate regularly with the EPA Remedial Project Manager (RPM)
- Prepare staffing plans

The Program Support Office personnel will:

- Review the work assignment technical and financial status
- Review the monthly progress report
- Provide technical resource management
- Review the work assignment budget

- Respond to questions from the EPA project officer and contracting officer
- Prepare and submit invoices

5.1.2 Attend Scoping Meeting

Following the receipt of this work assignment on September 28, 2005, the CDM RAC II technical operations manager (TOM) attended an initial scoping meeting with the EPA Project Officer (PO), Contracting Officer (CO), and RPM in New York on October 17, 2005, to outline and discuss the project scope.

5.1.3 Conduct Site Visit

The CDM SM, TOM, and SS conducted a site visit with EPA on November 9, 2005 to develop a better understanding of local and site-specific conditions. The site visit consisted of visual observation of site conditions, current use, and evaluating potential logistical and health and safety issues.

5.1.4 Develop Draft Work Plan and Associated Cost Estimate

CDM has prepared this RI/FS work plan in accordance with the contract terms and conditions. CDM used existing site data and information, information from EPA guidance documents (as appropriate) and technical direction provided by the EPA RPM as the basis for preparing this work plan.

This work plan includes a comprehensive description of project tasks, the procedures to accomplish them, project documentation, and a project schedule. CDM uses internal quality assurance/quality control (QA/QC) systems and procedures to insure that the work plan and other deliverables are of professional quality requiring only minor revisions (to the extent that the scope is defined and is not modified). Specifically, the work plan includes the following:

- Identification of RI project elements including planning and activity reporting documentation, field sampling, and analysis activities. A detailed work breakdown structure of the RI corresponds to the work breakdown structure provided in the EPA SOW (dated September 28, 2005) and discussions with EPA.

- CDM's technical approach for each task to be performed, including a detailed description of each task, the assumptions used, any information to be produced during and at the conclusion of each task, and a description of the work products that will be submitted to EPA. Issues relating to management responsibilities, site access, site security, contingency procedures and storage and disposal of investigation derived wastes are also addressed. Information is presented in a sequence consistent with the SOW.

- A schedule with dates for completion of each required activity, critical path milestones and submission of each deliverable required by the SOW and the anticipated review time for EPA.

- A list of key contractor personnel supporting the project (Section 7) and the subcontractor services required for the work assignment.

CDM will prepare and submit a draft work plan budget (as Volume II of the RI/FS work plan) that follows the work breakdown structure in the SOW. The draft work plan budget contains a detailed cost breakdown, by subtask, of the direct labor costs, subcontractor costs, other direct costs, projected base fee and award fee pool, and any other specific cost elements required for performance of each of the subtasks included in the SOW. Other direct costs are broken down into individual cost categories as required for this work assignment, based on the specific cost categories negotiated under CDM's contract. A detailed rationale describing the assumptions for estimating the professional level of effort (PLOE), professional and technical levels and skills mix, subcontract amounts, and other direct costs are provided for each subtask in the SOW.

5.1.5 Negotiate and Revise Draft Work Plan/Budget

CDM personnel will attend a work plan negotiation meeting at EPA's direction. EPA and CDM personnel will discuss and agree upon the final technical approach and costs required to accomplish the tasks detailed in the work plan. CDM will submit a negotiated work plan and budget incorporating the agreements made in the negotiation meeting. The negotiated work plan budget will include a summary of the negotiations. CDM will submit the negotiated work plan and budget in both hard copy and electronic formats.

As discussed in Section 4.2 (Work Plan Approach), due to uncertainties regarding source areas and identification of a PRP, a number of assumption were made concerning investigation quantities (number of wells, number of samples, sample locations, etc.) especially for Stage II activities. In addition, one of the primary objectives of the Stage I investigation is identification of source areas and support of EPA's efforts to identify PRPs. At any point in the investigation EPA may identify a PRP and may elect to transfer the investigation from its current status as a fund-lead investigation to a PRP-lead investigation. If EPA identifies a PRP, if directed by EPA, CDM will prepare a work plan defining the remaining RI/FS activities for use by the PRP. It is assumed that the work plan will be prepared at the end of the Stage I field investigation. A cost estimate to prepare the work plan is included in the Volume II work plan.

In the event that a PRP is not identified, and if needed, CDM will prepare a work plan letter at the conclusion of the Stage I activities. The work plan letter will define technical modifications and cost increases or decreases for tasks identified in the SOW. A cost estimate to prepare the work plan letter is provided in the Volume II work plan.

5.1.6 Evaluate Existing Data and Documents

As part of the preparation of the work plan, CDM reviewed data collected during previous investigations at the site. Analytical data and other information from these background documents were incorporated, where applicable, into this planning document. Existing data are summarized in Sections 2 and 3.

The initial Technical Scoping Meeting was held on October 26, 2005. The meeting was attended by CDM personnel, including the TOM, SM and Senior Scientist (SS). EPA attendees included the PO, RPM, Project Hydrogeologist (PH), Project Risk Assessor (RA), and two technical specialists.

5.1.7 Quality Assurance Project Plan

Quality Assurance Project Plan

CDM will prepare a QAPP in accordance with the Uniform Federal Policy (UFP) for QAPPs and current EPA Region II guidance and procedures. The QAPP will be submitted as a separate deliverable. The QAPP describes the project objectives and organization, functional activities, and QA/QC protocols that will be used to achieve the required DQOs. The DQOs will, at a minimum, reflect the use of analytical methods to identify and address contamination consistent with the levels for remedial action objectives identified in the NCP.

The QAPP includes sampling objectives; sample locations and frequency; sampling equipment and procedures; personnel and equipment decontamination procedures; sample handling and analysis; and a breakdown of samples to be analyzed through the CLP and through other sources, as well as the justification for those decisions. The QAPP is written so that a field sampling team unfamiliar with the site would be able to gather the samples and field measurements. Technical Standard Operating Procedures (SOPs) are included in the QAPP. Each SOP or QA/QC protocol has been prepared in accordance with EPA Region II guidelines and the site-specific Health and Safety Plan (HSP).

The QAPP also addresses site management, including site control and site operations. The site control section describes how approval to enter the areas of investigation will be obtained, along with the site security control measures, and the field office/command post for the field investigation. The logistics of all field investigation activities are described. The site operations section includes a project organization chart and delineates the responsibilities of key field and office team members. A schedule will be included that shows the proposed scheduling of each major field activity.

Any significant changes to the QAPP will require an amendment; minor changes will be documented on a Field Change Request Form and submitted in a letter to the EPA RPM and EPA quality assurance officer.

Other Quality Assurance/Quality Control Activities

Quality assurance activities to be performed during the implementation of this work plan may also include internal office and field or laboratory technical systems audits, field planning meetings, and quality assurance reviews of all project plans, measurement reports, and subcontractor procurement packages. The quality assurance requirements are discussed further in Section 7.2 of this work plan.

5.1.8 Health and Safety Plan

CDM will prepare an HSP in accordance with 40 CFR 300.150 of the NCP and 29 CFR 1910.120 (1)(1) and (1)(2). The HSP includes the following site-specific information:

- Hazard assessment
- Training requirements
- Definition of exclusion, contaminant reduction, and other work zones
- Monitoring procedures for site operations
- Safety procedures
- Personal protective clothing and equipment requirements for various field operations
- Disposal and decontamination procedures
- Other sections required by EPA

The HSP also includes a contingency plan which addresses site specific conditions which may be encountered.

In addition to the preparation of the HSP, health and safety activities will be monitored throughout the field investigation. The HSP will specify air monitoring procedures in the exclusion zone established around the drilling rig or sampling locations. A qualified health and safety coordinator, or designated representative will attend the initial field planning meeting and may perform a site visit to ensure that all health and safety requirements are being adhered to. A member of the field team will be designated to serve as the onsite health and safety coordinator throughout the field program. This person will report directly to both the field team leader and the health and safety coordinator. The HSP will be subject to revision, as necessary, based on new information that is discovered during the field investigation.

5.1.9 Non-RAS Analyses

This subtask is not required for this work assignment. Non-RAS analyses are described in Section 5.4.3.

5.1.10 Meetings

CDM will participate in various meetings with EPA during the course of the work assignment. As directed by EPA's SOW, CDM has assumed eight meetings, with two people in attendance, for four hours per meeting. Six of these meeting will be held in Puerto Rico and two will be held in New York. CDM will prepare minutes which list the attendees and summarize the discussions in each meeting.

The primary Technical Scoping Meeting was held on December 13, 2005 to present to EPA the technical approach of the Cidra RI/FS Work Plan. CDM meeting attendees included the TOM, SM, SS, Work Plan Coordinator (WPC), RA, and Technical Advisor (TA). EPA attendees included the Project Officer (PO), RPM, Project hydrologist (PH), Risk Assessor (RA), two QA representatives, site attorney, and a technical specialist.

5.1.11 Subcontract Procurement

This subtask will include the procurement of all subcontractors required to complete the field investigation activities. Procurement activities include: preparing the technical statement of work; preparing Information for Bidders (IFB) or Request for Proposal (RFP) packages; conducting pre-bid site visits (when necessary); responding to technical and administrative questions from prospective bidders; performing technical and administrative evaluations of bid documents; performing the necessary background, reference, insurance, and financial checks; preparing consent packages for approval by the EPA contracting officer (when necessary); and awarding the subcontract.

To support the proposed field activities, the following subcontractors will be procured:

- A licensed driller to drill bedrock boreholes and soil borings, and install multiport monitoring wells.
- A multiport well vendor to provide multiport well components and sampling apparatus.
- An analytical laboratory subcontractor to perform non-RAS analyses described in Section 5.4.3 and on Table 5-1
- A geophysical services contractor to perform downhole geophysical logging, packer sampling, and packer testing.
- A licensed surveyor to develop a detailed topographic map of the site and surrounding area and to survey the location and elevation of all monitoring wells, piezometers, and staff gauges that will be installed during the RI/FS.
- A cultural resources subcontractor to conduct a Phase IA survey of the local area
- A subcontractor to haul and dispose of investigation derived waste (IDW), responsible for the removal and proper disposal of drums and storage tanks containing RI generated waste liquids and solids

All subcontractor procurement packages will be subject to CDM's technical and quality assurance reviews.

5.1.12 Subcontract Management

The CDM SM and the CDM subcontracts managers will perform the necessary oversight of the subcontractors (identified under Section 5.1.11) needed to perform the RI/FS. CDM will institute procedures to monitor progress, and maintain systems and records to ensure that the work proceeds according to the subcontract and RAC II contract requirements. CDM will review and approve subcontractor invoices and issue any necessary subcontract modifications.

5.1.13 Pathway Analysis Report

In accordance with OSWER Directive 9285.7-47 entitled *Risk Assessment Guidelines for Superfund - Part D* (2001a), CDM will provide EPA with standard tables, worksheets, and supporting information for the risk assessment as an interim deliverable prior to preparation of the full baseline human health risk assessment report. CDM will prepare a Pathways Analysis Report (PAR) that consists of Risk Assessment Guidance for Superfund (RAGS) Part D Standard Tables 1 through 6 and supporting text. The PAR will summarize the key assumptions regarding potential receptors, exposure pathways, exposure variables, chemical distribution, and chemical toxicity values that will be used to estimate risk in the baseline human health risk assessment. Because RAGS Part D Tables 2 and 3 summarize site data, these tables of the PAR will be prepared after analytical data collected during the RI site investigation are available. Preparation of the PAR initiates the risk assessment process, whose components are described in greater detail in Section 5.7.1.

CDM will coordinate with EPA to define potential exposure pathways and human receptors. To accomplish this, CDM will review all available information obtained from EPA pertaining to the Cidra site, including data generated during previous investigations. CDM will integrate this information with site data generated during the RI site investigation. Background information on the site will be summarized, and samples will be collected, and the data analyzed for various media will be discussed. The treatment of data sets (e.g., duplicates, splits, blanks [trip, field, and laboratory], multiple rounds, and qualified and rejected data) will be discussed, and chemical-specific exposure point concentrations (EPCs) for each exposure scenario will be estimated. Based on current knowledge, potential receptors include users of private water wells (assuming that treatment of the water is not in place) that draw on the contaminated portion of the aquifer. The receptors with the highest potential exposures are residents (adults and children) who use the groundwater as drinking water. Exposure variables to be used for the calculation of daily intakes will be presented. Carcinogenic and noncarcinogenic toxicity values for chemicals of potential concern and the sources of these values will be presented in the PAR. As noted above, the selection of chemicals of potential concern, exposure pathways and receptors, exposure concentrations, exposure variables, and toxicity values will be summarized in tabular form in accordance with the Standard Tables of RAGS Part D.

Upon EPA's approval of the PAR, CDM will estimate potential exposures and risks associated with the site and initiate preparation of the draft baseline human health risk assessment report as described in Section 5.7.1.1.

5.2 Task 2 - Community Involvement

CDM will provide technical support to EPA during the performance of the following community involvement activities throughout the RI/FS in accordance with *Community Relations in Superfund-A Handbook* (EPA 1992b).

5.2.1 Community Interviews

CDM will perform the following activities:

- Preparation for Community Interviews - CDM will review background documents and provide technical and bilingual support to EPA in conducting community interviews with government officials (federal, Commonwealth, town, or city), environmental groups, local broadcast and print media, either in person or by telephone.

- Questions for Community Interviews - CDM will prepare draft interview questions in both Spanish and English for EPA's review. Final questions will reflect EPA's comments on the draft questions.

5.2.2 Community Involvement Plan

CDM will prepare a draft Community Involvement Plan (CIP) that presents an overview of community concerns. The CIP will include:

- Site background information including location, description, and history

- Community overview including a community profile, concerns, and involvement

- Community involvement objectives and planned activities, with a schedule for performance of activities

- Mailing list of contacts and interested parties

- Names and addresses of information repositories and public meeting facility locations

- List of acronyms

- Glossary

CDM will submit a Final CIP which reflects EPA's comments.

5.2.3 Public Meeting Support

CDM will perform the following activities in support of six public meetings and availability sessions.

- Make reservations for meeting space, in accordance with EPA's direction

- Attend three public meetings and three availability sessions, and prepare draft and final meeting summaries

- Reserve a court reporter for each of the three public meetings

- Provide full-page and "four on one" page copy of meeting transcripts, both in hard copy and on a 3.5-inch diskette in Word Perfect 12, or other format

- Prepare and maintain a sign-in sheet for each public meeting

CDM will develop draft visual aids (i.e., transparencies, slides, and handouts) as instructed by EPA. CDM will develop final visual aids incorporating all EPA comments. For budgeting purposes, CDM will assume 35 slides and 75 handouts for each public meeting. The handouts will be prepared in English and Spanish.

5.2.4 Fact Sheet Preparation

CDM will prepare draft information letters/updates/fact sheets. CDM will research, write, edit, design, lay out, and photocopy the fact sheets. The fact sheets will be written in both English and Spanish. CDM will attach mailing labels to the fact sheets before delivering them to EPA from where they will be mailed. For budgeting purposes, CDM will assume three fact sheets (one for each public meeting), three to five pages in length, with four illustrations per fact sheet. CDM assumed 150 copies of each fact sheet will be provided to EPA. Final fact sheets will reflect EPA's comments.

5.2.5 Proposed Plan Support

CDM will provide administrative and technical support for the preparation of the draft and final Proposed Plan describing the preferred alternative and the alternatives evaluated in the FS. The Proposed Plan will be prepared in accordance with the NCP and the most recent version of *EPA Community Relations in Superfund - A Handbook* (EPA 1992b). The Proposed Plan will describe opportunities for public involvement in the ROD. The Proposed Plan will be written in English and Spanish.

A draft and final Proposed Plan will be prepared. The final will reflect EPA comments.

5.2.6 Public Notices

CDM will prepare newspaper announcements/public notices for each public meeting, for inclusion in the most widely read local newspapers, with each ad placed in two large area wide newspapers and a small town local newspaper. Three public announcements/notices will be in both English and Spanish.

5.2.7 Information Repositories

In accordance with the SOW, this subtask is currently not applicable to this work assignment.

5.2.8 Site Mailing List

CDM will update the community relations mailing list two times for the Cidra site. The mailing list will be developed under Subtask 5.2.2 and is estimated to consist of 150 names. CDM will provide EPA with a copy of the mailing list on diskette and mailing labels for each mailing. EPA will do the actual mailing of any information to the community.

5.2.9 Responsiveness Summary Support

CDM will provide administrative and technical support for the Cidra site Responsiveness Summary. The draft document will be prepared by compiling and summarizing the public comments received during the public comment period on the Proposed Plan. CDM will prepare technical responses for selected public comments, for EPA review and use in preparing formal responses. CDM assumes 150 separate comments will be received and that 150 responses will be necessary.

5.3 Task 3 - Field Investigation

This task includes all activities related to implementing field investigations for the RI/FS for the Cidra site. The task descriptions have been developed after review and evaluation of site background data currently available to CDM. Section 4.2 - Work Plan Approach - describes the technical approach to the field investigation, field investigation activities, field investigation staging, media to be investigated, and anticipated laboratory analyses.

5.3.1 Site Reconnaissance

To complete this RI/FS work plan, CDM conducted an initial site visit to become familiar with local and site-specific conditions. CDM's SM and RI task manager conducted a reconnaissance of the site and surrounding area to evaluate logistical problems relevant to installation of monitoring well installation, sampling wells and implementation of the soil boring, surface water, and sediment sampling programs. The site reconnaissance was led by EPA's RPM.

Additional site reconnaissance activities will be performed to support mobilization and to prepare for drilling and sampling activities. During the site reconnaissance, sampling locations will be identified and marked; property boundaries and utility rights-of-way will be located; utility mark outs will be performed; and photographs will be taken. Site reconnaissance activities also include oversight of the cultural resources subcontractor and surveying subcontractor.

Individual reconnaissance activities are required to support implementation of specific sampling programs. Site reconnaissance activities are anticipated prior to conducting the following sampling activities:

- Soil boring/monitoring well installation reconnaissance prior to Stage I and Stage II
- Topographic survey oversight
- Surface water and sediment sampling
- Cultural resources survey

5.3.1.1 Soil Boring/Monitoring Well Installation Reconnaissance

Prior to soil sampling and drilling activities the field team will visit proposed borehole and monitoring well locations to identify exact drilling locations and assess potential logistical issues and physical access constraints for the drill rig. Potential problem locations will be documented and photographed and locations may be adjusted to facilitate access. It is anticipated that reconaissance activities will take place at two points during the field investigation: before the Stage I field investigation and before the Stage II field investigation.

5.3.1.2 Topographic Survey Oversight

A topographic map of the site will be created that shows all relevant physical features of the area.

It is anticipated that survey activities will occur during both stages of the Cidra site field investigation; at the conclusion of the Stage I activities and at the conclusion of the Stage II activities. At the conclusion of the Stage I activities, the location and elevation of all closed public supply wells, and monitoring wells installed will be surveyed. CDM will survey the source area soil sampling locations using Global Positioning System (GPS). At the conclusion of the Stage II activities, the location and elevation of additional monitoring wells installed and the top of staff gauges will be surveyed. CDM will survey surface water and sediment locations using GPS.

Three elevations will be determined at each of the closed public supply wells and piezometers: the ground surface, top of the inner casing, and top of the outer casing. Two elevations will be determined for the multiport monitoring wells: the top of the multiport casing and the ground surface adjacent to the casing. During installation, multiport monitoring well ports will be referenced to the ground surface adjacent to the well. The reference points will be surveyed after the wells are installed.

The production wells will not be surveyed.

5.3.1.3 Surface Water and Sediment Sample Location Reconnaissance

Prior to collection of surface water and sediment samples the field team will visit proposed sample locations to assess potential logistical issues and physical access constraints. The field team will determine the sedimentary depositional environment. Potential problem locations will be documented and photographed and locations may be adjusted based on findings of the reconnaissance. It is anticipated that the surface water and sediment sample locations reconnaissance activities will be conducted in the Stage II field investigation.

5.3.1.4 Cultural Resources Survey Oversight

Prior to initiating Stage II field activities, a subcontractor to CDM will conduct a cultural resources survey of the entire plume area. The Stage 1A Cultural Resources Survey will be prepared in order to determine the presence or absence of cultural resources which may be impacted by the implementation of any remedial actions. The Stage IA survey is the initial level of survey and requires comprehensive documentary research and an initial walk-over reconnaissance and surface inspection. CDM will oversee the on-site activities of the cultural resources subcontractor.

5.3.2 Mobilization and Demobilization

This subtask will consist of property access assistance; field personnel orientation; field office and equipment mobilization and demobilization; and field supply ordering, staging, and transport to the site.

5.3.2.1 Site Access Support

Access to public areas (roads, parks, etc.) and private property will be needed to execute the field investigation. EPA will be responsible for obtaining site access. CDM will assist EPA with site access. Significant access support is anticipated for the following field sampling activities:

- Existing monitoring well evaluation and sampling
- Soil borings at the nine potential source areas
- Monitoring well installation and sampling

CDM will provide a list of property owners (public and private) to be accessed during the existing monitoring well evaluation and sampling. The list will include the mailing address and telephone number of the property owners. Once EPA has established that access has been granted, sampling activities can begin. CDM will contact and coordinate with property owners and local officials (for work in public areas) to schedule sampling activities.

5.3.2.2 Field Planning Meetings

Prior to RI field activities, each field team member will review all project plans and participate in a field planning meeting conducted by the CDM SM and RI task manager to become familiar with the history of the site, health and safety requirements, field procedures, and related QC requirements. All new field personnel will receive a comparable briefing if they do not attend the initial field planning meeting and/or the tailgate kick-off meeting. Supplemental meetings may be conducted as required by any changes in site conditions or to review field operation procedures.

5.3.2.3 Field Equipment and Supplies

Equipment and field supply mobilization will entail ordering, renting, and purchasing all equipment needed for each part of the RI field investigation. This will also include staging and transferring all equipment and supplies to and from the site. Measurement and Test Equipment (M&TE) forms will be completed for rental or purchase of equipment (instruments) that will be utilized to collect field measurements. The field equipment will be inspected for acceptability, and instruments calibrated as required prior to use. This task also involves the construction of a decontamination area for sampling equipment and personnel. A separate decontamination pad will be constructed by the drilling subcontractor for drilling equipment.

It is anticipated that one major mobilization will be required at the beginning of the Stage Ia field activities and that a major demobilization will be required at the end of the Stage II field activities. Minor demobilization and mobilization activities will be required at the completion of Stage Ib, and at the beginning Stage II, respectively.

Field Trailer, Utilities, and Services

EPA will assist with finding a suitable location for the command post area.

Arrangements for the lease of a field trailer and associated utilities, a secure storage area for IDW, trash container, and portable sanitary facilities will be made. The command post area must be large enough to accommodate a 40-foot office trailer, at least two 20 cubic yard roll-off containers, one 10,000 gallon tank, portable sanitary facilities, a decontamination area, drilling equipment and supplies, drill rigs and subcontractor support vehicles, and CDM vehicles.

Health and safety work zones including personnel decontamination areas will be established. Local authorities such as the police and fire departments will be notified prior to the start of field activities. Equipment will be demobilized at the completion of each field event, as necessary. Demobilized equipment will include sampling equipment, drilling subcontractor equipment, health and safety equipment, and decontamination equipment.

5.3.2.4 Site Preparation and Restoration

Site Preparation

CDM will conduct ground truthing for overhead utilities and surface features around intrusive subsurface sampling locations. The drilling subcontractor will be responsible for contacting an appropriate utility location service to locate and mark out underground utilities.

CDM plans to use existing roadway rights-of-way, open space, and clearings to the maximum extent possible to access sampling locations. However, it may be necessary to clear some areas of vegetation and trees in order to access sampling locations. The drilling subcontractor will be responsible for clearing vegetation. CDM will direct and oversee any necessary clearing activities conducted by the drilling subcontractor.

Site Restoration

Some field activities are expected to occur on private and public properties. In the event that properties are impacted by field activities, the property will be restored, as near as practicable, to the conditions existing immediately prior to such activities. CDM will maintain photographic documentation of site conditions prior to commencement of and after completion of RI field activities.

At the completion of the field activities, decontamination pad materials will be decontaminated and removed from the command post area, unless otherwise instructed by EPA. The decontamination and command post area will be restored, as near as practicable, to its original condition.

CDM personnel will perform field oversight and health and safety monitoring during all site restoration field activities.

5.3.3 Hydrogeological Assessment

This section defines the objectives of the hydrogeological assessment and describes the hydrogeologic investigation activities that will be performed to identify potential source areas and define the nature and extent of groundwater contamination at the Cidra site. Section 4.2 - Work Plan Approach - describes the technical approach to the hydrogeological investigation, field activities, field investigation staging, media to be investigated, and anticipated laboratory analyses.

This work plan divides the hydrogeologic investigation activities into two major portions referred to as Stages I and II. The Stage I investigation is further divided into two portions; Stage Ia and Stage Ib. The work plan structure has been modified to accommodate the sequential nature of the hydrogeological investigation. Thus, hydrogeological investigation activities needed to define the nature and extent of groundwater contamination are described in three separate sections; Stage Ia, Stage Ib, and Stage II.

5.3.3.1 Stage Ia Hydrogeological Investigation

This section defines the objectives and activities of the Stage Ia hydrogeological investigation. Stage Ia focuses on investigation activities in the vicinity of the affected municipal wells. The primary objectives of the Stage Ia hydrogeological investigation include assessment of the condition and sampling of existing wells to confirm existing data, initial definition of the contaminant distribution in the vicinity of the affected wells, and collection of hydrogeologic and geologic data to support subsequent stages of the investigation, and to support identification of contaminant source areas.

5.3.3.1.1 Existing Well Evaluation and Sampling

The objectives of the existing well evaluation and sampling program are as follows:

- Update sample results from previous sampling of the wells
- Assess the condition of the inactive public supply wells
- Provide preliminary data on the vertical distribution of groundwater contamination in the inactive public supply wells

Groundwater samples will be collected from the four inactive public supply wells and 11 industrial wells in the site vicinity. Table 5-2 identifies the wells that will be sampled; summarizes the available information for the public supply and industrial wells; and shows the proposed sample collection methods and analyses.

For the industrial wells, samples will be collected directly from the well head or as close to the wellhead as possible. The line will be purged prior to sampling. The purging and sampling procedures will be detailed in the site-specific QAPP.

Prior to sampling the inactive public supply wells, the condition of the wells will be assessed. Assessment of the public supply wells will include removal of the pumps and piping and use of a downhole televiewer to view the condition of the well. The assessment will note the depth and condition of the casing and screen (if present), the condition of the open hole portion of the well, and the depth of the well. The televiewer run in each well will be recorded and viewed in detail to identify fracture zones (if possible).

Additional downhole logging activities in the existing public supply wells was considered and discussed with EPA. Additional downhole logging in the existing public supply wells is not recommended at this time due to well construction constraints that limit the types of logs that can be run. It is recommended that the initial assessment activities (downhole televiewer and groundwater sampling) be performed and the data evaluated. If conditions in the public supply wells differ from the current understanding, then CDM will discuss the need for additional logging activities with EPA.

It is assumed three samples will be collected from each of the four inactive public supply wells. Sampling methods will depend on well construction (i.e., screened or open hole construction as determined from the televiewer run). A submersible pump will be used to collect samples from wells that are screened. Samples will be collected from three separate intervals in the screened wells using the low-flow sampling method. One sample will be collected near the top of the water table or the top of the screen. The second sample will be collected near the bottom of the well and the third sample will be collected approximately midway between the top and bottom sample locations. Turbidity, pH, temperature, conductivity, and dissolved oxygen will be monitored during sampling. Samples will be collected after all parameters have stabilized (within 10 percent for successive measurements) and the water is clear.

For open hole wells, the downhole televiewer data collected during the investigation will be reviewed and, if the data are sufficiently detailed to identify fracture zones in the well, those zones will be targeted for sampling. If the well condition allows, samples in open hole wells will be collected using a straddle packer system to isolate fracture zones and collect discreet samples from those zones. At least three packer volumes will be pumped from the packed interval prior to sampling. Turbidity, pH, temperature, conductivity, and dissolved oxygen will be monitored during pumping. Once the parameters have stabilized (within 10 percent for successive measurements) the well will be sampled using the low-flow sampling method.

EPA will be notified of the public water supply well sampling results as soon as they are available.

Industrial and inactive public supply wells will be sampled for LDL VOCs; TCL SVOCs, pesticides/PCBs, and TAL metals. Sampling procedures will be detailed in the site-specific QAPP.

5.3.3.1.2 Borehole Drilling and Coring

This section describes the borehole drilling and coring activities that will be performed as part of Stage Ia. Multiport monitoring wells will be installed during Stage Ib of the RI, after the borehole logging, packer sampling, packer testing, and water level measurements of Stage Ia are completed.

The primary objectives of the Stage Ia borehole drilling and coring are to:

- Advance a borehole for subsequent packer sampling and packer testing
- Collect lithologic and stratigraphic data to refine the CSM
- Advance boreholes for packer testing
- Advance appropriate boreholes for subsequent multiport monitoring well installation and sampling to define potential contaminant sources and define contaminant distribution.

It is assumed that the Stage Ia boreholes will be completed as multiport wells (in Stage Ib) with up to six ports per well. The specific multiport monitoring system and the number and location of individual ports installed in each borehole will be determined based on the results of the Stage Ia hydrogeological investigation. It is also assumed that the multiport system will be installed inside open, bedrock boreholes. At the conclusion of Stage Ia, a technical meeting will be held with EPA. In the meeting CDM will summarize the results of the Stage Ia investigation and include recommendations for the multiport monitoring system and the number and depths of monitoring ports to be installed in Stage Ib.

A total of six boreholes will be drilled in the vicinity of the affected municipal wells during Stage Ia. Figure 5-2 shows the approximate locations of the boreholes. The exact locations will be determined based on the monitoring well reconnaissance activities described in Section 5.3.1.1. Three boreholes will be drilled using the air rotary drilling method and three boreholes will be cored using standard rock coring methods. It is assumed that one borehole will be drilled to a depth of 325 feet below ground surface (bgs) and five will be drilled to 225 feet bgs. The borehole drilled to 325 feet bgs will be cored. Each borehole will be furnished with a multiport monitoring well system during Stage Ib. Table 5-3 shows the proposed drilling methods, testing, and rationale for the proposed borehole locations.

The well depths at Cidra 6 and Cidra 3 are 200 feet bgs and 110 feet bgs, respectively. The depths at Cidra 4 and Cidra 8 are unknown at this time but are assumed to be installed to similar depths as Cidra 6 and Cidra 3. The well depths at Zenith/IVAX 1 and Zenith/IVAX 2 are 407 feet bgs and 367 feet bgs, respectively. Little is known about the structure of the bedrock, so it is not possible at this time to establish a firm maximum depth for the boreholes based on the depth of contamination, relative permeability of aquifer units, or aquifer structure.

Analytical data from discrete-level sampling of the existing wells is expected to provide initial data to support evaluation of the depth of contamination within the aquifer. The maximum depth of contamination was about 400 feet in the Zenith/IVAX 1 Well (based on a single sample collected from the wellhead). However, drilling all wells to 400 feet may not be needed if contamination is present only in shallower zones. The actual borehole depths will be determined in consultation with EPA following the sampling of the site area supply wells and discrete zone sampling in the public supply wells.

At this point in the planning process, it is proposed to drill the five boreholes in the vicinity of the closed Cidra supply wells to 225 feet bgs and the one borehole at the Zenith/IVAX Facility to 325 feet bgs.

Table 5-3 summarizes borehole locations, proposed testing at each borehole, and the rationale for the location of each well. The following sections describe drilling methods for Stage Ia boreholes.

Borehole Drilling With Rock Coring

Three of the Stage Ia boreholes (MPW 2, 3, and 6 in Figure 5-2) will be advanced using rock coring techniques in the bedrock. Rock coring will be performed to provide information to verify downhole geophysical logging data. The unconsolidated soil portion of the borehole will be advanced from the ground surface to the bedrock using 8-inch diameter air rotary drilling; a 4-inch diameter carbon steel casing will be tightly sealed into competent bedrock using a cement/bentonite grout slurry. Upon installation of the outer steel casing, an HQ (3.78 inch diameter) rock coring bit will be used to advance a nominal 4-inch diameter borehole to depth. The on-site geologist will log the rock core, place the core in a core box, and store the core box for future reference. Rock cores, overburden cuttings, and rock cuttings will be screened using a PID or FID. The rock cores will either be transferred to an archive (e.g., USGS archive, Puerto Rico government archive, EPA archive) or disposed of at the completion of the work assignment.

After completion of subsequent downhole geophysical logging and packer sampling, a temporary liner or packer will be installed in the borehole to prevent inter-borehole flow and cross contamination among different fracture zones within the well.

Borehole Drilling With Air Rotary

The remaining three Stage Ia boreholes will be advanced using air rotary drilling methods in the bedrock. Air rotary drilling will be used to advance the borehole through the unconsolidated material to the bedrock using an 8-inch drill bit; a 4-inch diameter carbon steel casing will be tightly sealed into competent bedrock surface using a cement/bentonite grout slurry. Upon installation of the outer steel casing, the borehole will be advanced through the bedrock using the air rotary with direct circulation drilling method with a nominal 4-inch (3.78 inch) diameter hammer bit to create a nominal 4-inch borehole.

The on-site geologist will monitor and record the materials brought to the surface by air rotary drilling methods. Overburden cuttings, and rock cuttings will be screened using a PID or FID.

Borehole Development

Boreholes will be developed to remove fines and drilling fragments from the borehole and to clear borehole fractures. Due to the nature of the drilling techniques (air rotary and rock coring), boreholes are expected to require moderate development. However, development will be required to ensure that the boreholes are clean and properly prepared for subsequent packer sampling, downhole logging, and multiport monitoring wells. Wells will be developed by pumping to ensure that fines are removed and groundwater is not turbid. Turbidity, pH, temperature, conductivity, and dissolved oxygen will be monitored during development. Development will continue until all parameters have stabilized (within 10 percent for successive measurements) and the water is clear. Well development procedures will be detailed in the site-specific QAPP.

Drilling Waste Management

Drill cuttings and water from drilling operations will be containerized at the drilling location and transported by the drilling subcontractor to a central waste storage area. Liquid wastes will be transferred to a 21,000 gallon Baker tank and drill cuttings will be transferred to 20 cubic yard roll-off containers for subsequent sampling, characterization, and disposal by CDM's IDW subcontractor.

5.3.3.1.3 Borehole Logging

The objectives of the borehole logging program are as follows:

- Define lithology and stratigraphy including the location and orientation of fractures and bedding planes
- Identify groundwater flow within the well including water entry and exit points
- Provide a basis for selection of packer sampling intervals and multiport monitoring well port depths

Following drilling, each of the six boreholes will be geophysically logged. The following suite of borehole logs will be run, for the purposes indicated:

- Fluid resistivity and temperature (one tool). Data from these logs indicate borehole fluid entry/exit points.
- Natural gamma. Correlate with rock cores to define stratigraphy.
- Optical televiewer. Data shows borehole wall lithology, strike and dip of fractures and bedding planes. If the borehole fluid is too cloudy, the acoustic televiewer/caliper (one tool) may be used.

- Mechanical caliper. Data shows borehole wall condition, useful for deciding where to place packers for sampling or multi-port well ports.

- Vertical Flow - Static (Heat Pulse) and Pumped (Heat Pulse) (one tool, 2 runs). Data shows fluid entry and exit points and flow rates.

Downhole geophysical logging will be performed by a subcontractor to CDM with experience performing downhole logging. The subcontractor will supply the necessary equipment and personnel to perform the logging. The CDM Hydrogeologist will direct and oversee the subcontractor. The geophysical data will be collected in electronic format and will be analyzed and evaluated by CDM to determine subsequent packer sample locations and multiport monitoring zones.

Borehole geophysical logging methods will be detailed in the site-specific QAPP.

5.3.3.1.4 Packer Sampling

The objective of the packer sampling is to collect discrete depth, screening-level groundwater data to establish the vertical boundaries of contamination and to provide contaminant distribution data to aid in the selection multiport monitoring well port placement. A straddle packer system will be used to isolate selected zones for groundwater sampling in the six boreholes drilled during Stage Ia. It is assumed that eight packer samples will be collected from the 325 foot borehole and five packer samples will be collected from each of the 225 foot boreholes for a total of 33 samples. In each well, one packer sample will be collected just below the water table and one packer sample will be collected at the bottom of the well. The remaining packer samples will be collected at depths determined from the geophysical logging data.

To facilitate the packer sampling, the downhole geophysical logging data will be reviewed on an ongoing basis by the CDM Hydrogeologist. The CDM SM and Hydrogeologist will provide recommendations for packer sampling intervals and discuss them with the EPA Hydrogeologist and RPM prior to collecting any samples.

A straddle packer system will be used to isolate selected sample intervals. Pressure transducers will be used to monitor water levels above, between, and below the packer system before, during, and after pumping. After the packers are inflated and prior to collecting the screening sample, CDM will evaluate the packer seal by conducting a slug test. If leakage occurs around the packers, the packer sampling subcontractor will try to improve the seal. After the seal quality is checked, a suitable pump will be used to pump water out of the isolated interval at a constant rate, while the water level changes above, between, and beneath the packers are monitored using pressure transducers. Packer sampling will begin at the bottom of the borehole and proceed upward. The packer assembly will not be removed between successive samples within the same borehole. The entire packer assembly including the pump will be decontaminated between boreholes and new tubing will be used at each borehole. Water quality parameters such as pH, temperature, conductivity, and dissolved oxygen will be monitored for stabilization prior to sample collection.

Once stabilization has occurred, the groundwater sample will be collected for analysis of LDL VOCs with a 24-hour turnaround basis. Sampling procedures will be detailed in the site-specific QAPP.

After completion of packer testing, the temporary packer or liner will be placed in the borehole to prevent intra-borehole flow.

5.3.3.1.5 Packer Testing

Packer testing using straddle packers will be conducted during Stage Ia, in conjunction with the packer sampling described in Section 5.3.3.1.4. The location and orientation of fractures within the bedrock aquifer may influence vertical and horizontal flow of contaminated groundwater. CDM will perform packer testing within the bedrock portion of the borehole to obtain transmissivity values for bedrock zones. After the boreholes are drilled, packer testing will be conducted to collect hydraulic data for up to three intervals in three of the six boreholes drilled in Stage Ia. The packer testing locations may be modified based on the results of the downhole logging program.

A straddle packer system will be used to isolate a 15-foot interval in the borehole. The testing intervals will be selected based on the downhole logging results. The testing will focus on transmissive zones, but will also include less transmissive zones to provide data on the variation in transmissivity within different aquifer zones. Pressure transducers will be used to monitor water levels above, between, and below the packer system before, during, and after pumping. Pressure transducers will also be installed to monitor drawdown in up to three nearby wells. The drawdown data will be used to assess fracture connectivity between the pumped well and the monitored wells. After the packers are inflated and prior to conducting a pump-out test, the subcontractor will evaluate the packer seal by conducting a slug test. If leakage occurs around the packers, the contractor will adjust the packer system and try to improve the seal.

After the seal quality is checked, a suitable pump will be used to pump water out of the isolated interval at a constant rate while the water level changes above, between, and beneath the packers is monitored using pressure transducers. Water quality parameters such as pH, temperature, conductivity, and dissolved oxygen will be monitored at the beginning, middle, and end of the pumping phase. Packer testing will be conducted as the packers are moved up the borehole. Packer testing is estimated to require two to three days per well.

The pump-out test will be conducted according to the CDM Site Specific Operating Procedure "Packer Testing Using the "Pump Out" Method". Water level data will be analyzed after the packer test is completed.

Prior to conducting the packer test, the selected test intervals will be reviewed with the EPA RPM and hydrogeologist. CDM will prepare a table of recommended packer test intervals including the rationale for selection of the test intervals.

Packer testing will be conducted by the CDM downhole geophysics subcontractor. The subcontractor will provide the necessary equipment, supplies, data acquisition hardware and software, and personnel to conduct the packer tests. The CDM Hydrogeologist will review packer testing data as it is collected in the field and oversee the packer testing subcontractor. The data will be analyzed using appropriate analytical solutions for determining transmissivity in packed intervals as presented in Goode and Senior (1998) concerning the North Penn Area 6 Superfund site in Pennsylvania and in Shapiro and Hsieh (1998) concerning the Mirror Lake site in New Hampshire. All water pumped from the well during packer testing will be contained and transported to a central storage tank. Water from this storage tank will be sampled for characterization, and the water will then be properly disposed of in accordance with applicable regulations.

5.3.3.1.6 Technical Meeting

CDM will prepare for and attend a technical meeting with EPA at the conclusion of the Stage Ia field investigation. At the meeting, CDM will present the data collected in Stage Ia and provide recommendations for Stage Ib activities. After the meeting, CDM will prepare a technical letter report defining the conclusions of the meeting.

The meeting will include the following major items:

- Presentation of the results of the Stage Ia investigation including existing well data, packer sampling data, and downhole geophysical logging
- Recommendations for and discussion of the locations of the two Stage Ib boreholes/multiport monitoring wells
- Recommendations for and discussion of the location of multiport monitoring ports within the six boreholes drilled during Stage Ia
- Recommendations for and discussion of selection of a multiport monitoring well system (previous meetings will have been held to review various multiport systems and their suitability for the site)
- Identification of potential source areas (from groundwater and soil data)
- Finalization of the multiport monitoring well system to be installed

It is anticipated that the Stage Ia technical meeting and technical letter report will not provide a detailed and comprehensive evaluation of the Stage Ia data since only a minimal time lag is expected between Stage Ia and Stage Ib. Therefore, it is anticipated that CDM will organize and evaluate Stage I data on an ongoing basis during the field investigation. During the Stage I investigation, CDM will transmit data to EPA on a regular basis and will discuss the results on an ongoing basis.

5.3.3.2 Stage Ib Hydrogeological Investigation

The overall objectives of the Stage Ib hydrogeological investigation are as follows:

- Verify and supplement Stage Ia data (fill data gaps identified in Stage Ia)
- Collect additional data to identify potential source areas
- Install permanent multiport monitoring wells to provide definitive level groundwater data

CDM does not anticipate a significant time lag between the completion of Stage Ia and the initiation of Stage Ib. Separation of these two stages is primarily to allow for communication of key Stage Ia results to EPA, assess the location of potential source areas identified in Stage Ia, and focus the Stage Ib investigation.

5.3.3.2.1 Borehole Drilling and Coring

For costing purposes it is assumed that two additional boreholes will be drilled during Stage Ib and that one of the boreholes will be cored and one will be drilled using the air rotary drilling method. The depths and locations of these wells will be determined based on the results of the Stage Ia investigation. Recommended depths and locations for the two wells will be provided in the Stage Ia technical memorandum described in Section 5.3.3.1.7. For cost estimating purposes, it is assumed that the cored borehole will be drilled to a depth of 325 feet bgs and the air rotary borehole will be drilled to a depth of 225 feet bgs. Drilling methods for the Stage Ib monitoring wells are identical to those described in Section 5.3.3.1.

5.3.3.2.2 Borehole Logging

Borehole logging will be performed in the two additional boreholes drilled during Stage Ib. For costing purposes, it is assumed that the same suite of geophysical logs that were run in the Stage Ia will be run in the two Stage Ib boreholes. The geophysical logging methods are identical to those described in Section 5.3.3.1.3 (borehole logging) of this work plan.

5.3.3.2.3 Packer Sampling

It is assumed that eight packer samples will be collected from the 325 foot borehole and five packer samples will be collected from the 225 foot borehole for a total of 13 samples. In each well, one packer sample will be collected just below the water table and one packer sample will be collected at the bottom of the well. The remaining packer samples will be collected at depths determined from the geophysical logging data described in Section 5.3.3.1.3. The downhole logging data will be reviewed on an ongoing basis by the CDM Hydrogeologist. The CDM SM and Hydrogeologist will provide recommendations for packer sampling intervals and discuss them with the EPA RPM and Hydrogeologist prior to conducting the packer sampling.

The packer groundwater sample will be collected for analysis of LDL VOCs with a 24-hour turnaround basis.

5.3.3.2.4 Long Term Water Level Monitoring

The overall objective of the long term water level monitoring program is to collect data to evaluate temporal fluctuations in water levels in the vicinity of the affected municipal supply wells in response to precipitation and local pumping. The data will also be used to support development of the site conceptual model and in the evaluation of groundwater flow.

Long term water level monitoring will be conducted in the six boreholes drilled during Stage Ia and the two boreholes drilled during Stage Ib and will occur over a period of eight weeks. Data will be collected using in-situ water level monitoring instruments capable of storing water level data for the duration of the test and equipped with barometric pressure compensation (Level Troll or equivalent). To provide baseline water levels and to verify the water level measurements, manual water levels will be collected at the start of monitoring; at weekly intervals during monitoring; and at the conclusion of the monitoring. To ensure that the instruments are operating properly, monitoring instruments will be checked on a weekly basis and the data downloaded and checked. At the end of the monitoring period, the data will be downloaded and stored for evaluation. To evaluate precipitation effects on water levels, precipitation data for the monitoring period will be obtained from the Aibonito 1 S weather station, located approximately seven miles southeast of the site.

Before initiating water level measurements, a survey of the location and elevation for each monitoring location will be made by a licensed land surveyor under subcontract to CDM. Elevation measurements will be made at marked water level measuring points on the steel casing and on the adjacent ground surface. The wells will be allowed to equilibrate after packer testing for a minimum of two weeks before long term water level monitoring begins.

5.3.3.2.5 Multiport Monitoring Well Installation and Sampling

Multiport monitoring wells will be installed in the eight boreholes drilled during Stage I (six boreholes drilled in Stage Ia and two boreholes drilled in Stage Ib). For costing purposes, It is assumed that six monitoring zones will be installed in each 325 foot deep well and five monitoring zones in each 225 foot well for a total of 42 monitoring zones. In addition, it is assumed that each monitoring zone will include a means to measure hydrostatic pressure (pressure port or transducer) within the zone.

Monitoring zones will be selected based on the Stage Ia and Ib downhole logging data, existing monitoring well data, and packer sampling data. Recommendations for the Stage Ia multiport monitoring zones and appropriate multiport monitoring system will be provided in the technical meeting described in Section 5.3.3.1.6. If the Stage Ib boreholes are drilled, separate recommendations for the number of ports and monitoring depths will be provided to EPA. It is assumed that one type of multiport system will be installed in all wells.

Upon selection of the intervals to be monitored, the multiport well assembly will be lowered inside the borehole to the target depths. The sampling ports will be spaced along the length of the open borehole at selected depths. Packers or liners (depending on the system selected) will be used to maintain isolation between sampling ports and to prevent cross contamination. A pressure port or pressure monitoring instrument will be installed in each monitoring zone. Multiport monitoring wells will be installed in accordance with manufacturer's instructions. CDM's drilling subcontractor will install the wells with technical support provided by the multiport well vendor or manufacturer. The CDM Hydrogeologist will direct and oversee the installation.

In general, multiport monitoring well systems do not allow for significant well development after installation. In general these systems do not allow pumping rates needed for thorough well development. Thorough development of the borehole will be performed before installation of the multiport system as described in Section 5.3.3.1.2. The objective of multiport well development will be to clear the sampling ports of any fines resulting from the installation process, ensure that the ports and other system components are operating properly, and to perform an initial purge of the sampling system. The development method used will depend on the multiport system installed and the recommendations of the manufacturer. Water quality parameters, including, turbidity, pH, temperature, conductivity, and dissolved oxygen will be monitored during development.

After development of the multiport system is complete, one round of samples will be collected. Sampling will occur a minimum of two weeks after development of the multiport system. Sampling will be performed in accordance with the manufacturer's sampling procedures for the specific multiport system that is installed. Details of the sampling procedures will be provided in the site-specific QAPP. Section 5.3.5 describes the multiport monitoring well sampling parameters.

Synoptic Water Level Measurements
To provide data to evaluate groundwater flow, one round of synoptic water level (pressure) measurements will be collected from the multiport monitoring wells in conjunction with the Stage Ib sampling event.

5.3.3.2.6 Technical Memorandum

A Technical Memorandum will be prepared at the conclusion of the Stage Ib investigation. The technical memorandum will include a more comprehensive data summary of the data previously outlined in the technical letter report, prepared at the conclusion of the Stage Ia. The primary objectives of this technical memorandum are to: summarize the data collected during Stage I, develop a detailed site conceptual model, and identify potential contaminant source areas or facilities. In addition, this technical memorandum will provide recommendations and the rationale for the Stage II activities to define the full nature and extent of contamination, including the following:

- Location and placement of additional multiport monitoring wells (if needed)
- Additional borehole logging activities (if needed)
- Additional packer sampling and packer testing activities (if needed)

- Additional source area soil sampling (if needed)
- Locations for groundwater/surface water interaction evaluation
- Locations for surface water and sediment samples
- Recommendations for a potential aquifer test

5.3.3.3 Stage II Hydrogeological Investigation

The Stage II hydrogeological investigation activities will be based on the findings of the Stage I investigation. Some uncertainty exists regarding the activities that will be performed and the quantities that will be needed. For example, if the Stage I investigation adequately defines the nature and extent of groundwater contamination, it may not be necessary to install additional monitoring wells. Alternatively, a limited number of wells may be needed to define groundwater contamination in a source area identified from the source area soil investigation. If optional aquifer testing is needed to evaluate aquifer properties across a wider portion of the aquifer boreholes proposed for Stage II may serve as observation wells. As a result, it was necessary to make assumptions in order to estimate costs for the Stage II investigation.

The primary objectives of the Stage II hydrogeological investigation are as follows:

- Fill any data gaps remaining in the nature and extent (both lateral and vertical) of groundwater contamination
- Define sources of groundwater contamination identified during Stage I
- Drill observation boreholes if the optional aquifer testing occurs
- Define groundwater/surface water interaction in areas of groundwater discharge to surface water

5.3.3.3.1 Borehole Drilling and Coring

This section describes the borehole drilling and coring for the Stage II hydrogeological investigation. The overall objective of the Stage II hydrogeological investigation is to define the nature and extent of groundwater contamination sufficiently to support development of remedial alternatives in the FS and a ROD. This includes defining the boundaries of groundwater contamination. The specific objectives of the Stage II borehole drilling and coring are to:

- Provide boreholes for subsequent packer sampling
- Collect lithologic and stratigraphic data to refine the CSM
- Provide boreholes for packer testing and an optional aquifer test

- Provide appropriate boreholes for multiport monitoring well installation

It is assumed that up to three boreholes will be drilled in Stage II. Two boreholes will be drilled using the air rotary drilling method and one borehole will be drilled using the standard coring method. It is assumed that the cored borehole will be drilled to a depth of 325 feet bgs and the two air rotary boreholes will be drilled to a depth of 225 feet bgs. The drilling and development methods will be the same as those described in Section 5.3.3.1.2 - Borehole Drilling and Coring. Exact depths and locations of the Stage II boreholes will be based on the technical memorandum II and will be submitted to EPA for approval prior to drilling.

5.3.3.3.2 Borehole Logging

It is assumed that borehole logging will be conducted in the three boreholes drilled during Stage II. The objectives of the Stage II borehole logging methods are the same as those described in Section 5.3.3.1.3.

5.3.3.3.3 Packer Sampling

The objective of the Stage II packer sampling is to collect groundwater data to verify the vertical boundaries of contamination and to provide contaminant distribution data to aid in the selection of multiport monitoring well zones. It is assumed that five packer samples will be collected from the 325 foot borehole and four samples will be collected from each of the 225 foot boreholes, for a total of 13 samples. In each well, one packer sample will be collected just below the water table and one packer sample will be collected at the bottom of the well. The remaining packer samples will be collected at depths determined from the Stage II borehole logging data (Section 5.3.3.3.2). Pressure transducers will also be installed to monitor drawdown in up to three nearby wells. The drawdown data will be used to assess fracture connectivity between the pumped well and the monitored wells.

Stage II packer sampling procedures are the same as those described in Section 5.3.3.1.4 - Packer Sampling. Packer samples will be analyzed for LDL VOCs on a 24-hour turnaround basis.

5.3.3.3.4 Optional Aquifer Test

After the results of Stage I are presented in the Technical Memorandum, CDM will consult with EPA to determine the need for aquifer testing. If aquifer testing is proposed, the location of boreholes and wells to be monitored and the most appropriate type of aquifer testing for the site will also be decided in consultation with EPA.

A step-drawdown test and a 72-hour constant-rate aquifer test may be conducted in the supply well most centrally located with respect to the groundwater plume as determined during the Stage I investigation. The tests will be performed to determine well yields (Q), aquifer transmissivity (T), and to determine fracture interconnectivity. Continuous water level measurements will be collected over the two week period prior to the aquifer test. Rainfall and barometric pressure will be measured during this period. The continuous water level monitoring will be conducted to determine the baseline groundwater conditions prior to the aquifer test.

Cross-borehole flowmeter pulse testing may also be performed at the site as an alternative to the constant-rate aquifer test,. Cross-borehole flowmeter pulse pumping could be performed in paired adjacent boreholes to estimate fracture connectivity and transmissivity across a section of the aquifer. For example, pulse pumping at 30-minute intervals could occur in one borehole while flow monitoring using either a heat pulse flowmeter or an electromagnet flowmeter will occur in the identified fracture zones in the adjacent borehole.

5.3.3.3.5 Multiport Monitoring Well Installation and Sampling

It is assumed that multiport monitoring wells will be installed in three boreholes drilled during Stage II. One well will be installed to 325 feet and two wells will be installed to 225 feet. It is further assumed that four monitoring zones will be installed in each well for a total of 12 monitoring zones. The CSM developed in Stage I will be available to aid in focusing the monitoring zones in Stage II wells. Each monitoring zone will include a means to collect a groundwater sample and measure hydrostatic pressure (pressure port or pressure measuring instrument). The Stage II downhole logging and packer sampling data will be used to identify specific multiport monitoring zones.

Once the Stage II multiport monitoring well installation is complete, two rounds of groundwater samples will be collected. It is assumed that both rounds will include the Stage I and Stage II multiport wells: Eight Stage I wells with 6 ports in each well (48 samples) and three Stage II wells with 4 ports in each well (12 samples) for a total of 60 samples in each round. Sampling is described in Section 5.3.5, Environmental Sampling.

Synoptic Water Level Measurements

To provide data to evaluate groundwater flow, two rounds of synoptic water level (pressure) measurements will be collected from all multiport monitoring wells in conjunction with the Stage II Round 1 and Round 2 sampling events.

5.3.3.3.6 Groundwater/Surface Water Interaction Investigation

The objective of the groundwater/surface water interaction investigation is to assess interaction between these two media in groundwater discharge areas. Discharge of contaminated groundwater to surface water has implications for the evaluation of human health and ecological risk. Current information is insufficient to evaluate the locations of contaminated groundwater discharge to surface water. It is anticipated that hydrogeologic data collected in Stage I will provide sufficient information to identify groundwater discharge areas. It is assumed that a preliminary groundwater/surface water interaction investigation will be conducted in two separate areas: one in a stream environment and one in a lake or static water body (possibly Lago de Cidra).

It is assumed that one piezometer and one staff gauge will be installed at each location. Staff gauges will be installed in the water bodies. Piezometers will be installed at locations as close as practicable to the staff gauges. To account for seasonal fluctuation in the groundwater table, piezometer screens will straddle the groundwater table. The staff gauge will consist of a calibrated scale affixed to a steel rod driven into the sediment. Staff gauges will be installed at locations that are accessible by wading. The top of the staff gauge will be surveyed so that water level measurements can be referenced to a known datum. The top of the piezometers and adjacent ground surface will also be surveyed and referenced to the same datum.

Two rounds of staff gauge readings and piezometer readings will be taken in conjunction with the two rounds of synoptic water level measurements in the monitoring wells. A detailed description of the groundwater/surface water interaction investigation will be provided in the site-specific QAPP.

5.3.4 Soil Boring, Drilling, and Testing

This section describes soil boring, drilling, and testing activities that will be performed as part of the RI investigation. The overall objective of the soil sampling is to characterize the surface and subsurface soils at nine potential source area facilities at the Cidra site. The nine facilities are: International Dry Cleaners, Former Excellent Dry Cleaners, Unnamed Former Dry Cleaners, CCL Label, Cidra Convention Center, Ivax/Zenith Facility, Pepsi, Esso Gas Station, and the Machine Shop adjacent to the Esso Gas Station. Figure 5-3 shows the proposed facilities for soil sampling. The data will supplement previous source area soil sampling conducted by EPA's Region II SAT (EPA 2003a). Soil sampling will be conducted during Stage Ia of the field investigation.

5.3.4.1 Industrial Facilities Source Area Investigation

At six of these nine facilities (CCL Label, Cidra Convention Center, Ivax/Zenith Facility, Pepsi, Esso Gas Station, and the Machine Shop) soil cores will be collected continuously to 12 feet bgs and then every 20 feet from 20 feet bgs to top of bedrock. The soil samples will be collected using a drive point technology (DPT) rig, with samples collected at 4-foot intervals. Ten locations at each facility will be chosen based on historical aerial photo evaluations and review of the facilities' 104 Forms. Based on an estimated depth to bedrock of 80 feet bgs, a total of 420 soil core samples will be collected.

Upon retrieval from the drill rod each 4-foot core will be screened for VOCs using a photoionization detector (PID). The onsite geologist will select the interval for analysis using the PID readings together with visual observations of any potential source materials. It is anticipated that one surface sample from the 0-1 foot interval, one shallow sample from the 4-12 foot interval, one intermediate sample from the 20-64 foot interval, and one from the bottom of the borehole will be collected and sent for laboratory analysis, a total of 240 samples. If significant contamination is identified in other depth intervals by either visual observation or PID readings, additional samples may be collected and documented in a Field Change Request Form.

The lithology of the each sample will be characterized and logged by the field geologist. Depth to groundwater, if encountered, and PID readings also will be recorded in the log. To prevent cross-contamination, drill rods will be decontaminated between successive locations and new, polyethylene sleeves will be used for each sample.

Surface and subsurface soil samples will be analyzed for full TCL/TAL. Twenty percent of the samples will be sent for pH, TOC and grain size distribution. Detailed sample collection and decontamination procedures will be provided in the QAPP.

5.3.4.2 Current and Former Dry Cleaners Source Area Investigation

DPT rig access will be impossible at International Dry Cleaners and the two former dry cleaner facilities located in the Cidra commercial district. The former dry cleaners have limited space available for soil sampling. The area available for sampling at each facility is a concrete covered, narrow alley of approximately 5 feet wide by 20 feet long. The samples are being collected for source identification not for risk assessment purposes since the concrete covering prohibits exposure to potential soil contamination at these sites. Surface and subsurface soils will be collected at four locations at these facilities using a hand auger from 0 - 2 feet bgs and from 4 - 6 feet bgs, for a total of 24 samples. Every soil sample will be screened for VOCs with a PID. To prevent cross-contamination, sampling apparatus will be decontaminated between successive locations.

Surface and subsurface soil samples will be analyzed for full TCL/TAL parameters. Twenty percent of the samples will be sent for pH, TOC, and grain size distribution. Detailed sample collection and decontamination procedures will be provided in the QAPP.

5.3.5 Environmental Sampling

Table 5-1 summarizes the number of samples and associated analytical parameters for the various environmental media that will be sampled during the RI. The FASTAC procedures will be followed. Unless otherwise specified, analysis for TCL/TAL parameters through the CLP will be performed in accordance with the most current EPA CLP statements of work for multi-media, multi-concentration analyses for organics and inorganics. Non-RAS parameters will be analyzed by EPA's DESA laboratory or CDM's analytical laboratory subcontractor. The laboratory subcontractor will be selected by EPA-approved criteria and will follow the most current EPA protocols and Region II QA requirements. The CDM Regional Quality Assurance Coordinator (RQAC) will ensure the laboratory meets all EPA requirements for laboratory services. QC samples will be collected in addition to the environmental samples discussed below. The number and type of QC samples will be in accordance with the EPA Region II CERCLA QA Manual.

5.3.5.1 Multiport Monitoring Well Sampling

One round of groundwater samples will be collected during Stage Ib and two rounds of groundwater samples will be collected during Stage II at the Cidra site to characterize the nature and extent of contamination in groundwater from contaminants associated with the site. Analytical data from groundwater sampling will be used to support preparation of the RI, HHRA, and FS reports.

5.3.5.1.1 Stage Ib Multiport Monitoring Well Sampling (Round 1)
Multiport monitoring wells will be installed in the eight boreholes drilled during Stage I (six boreholes drilled in Stage Ia and two boreholes drilled in Stage Ib). For costing purposes, it is estimated that a total of 42 ports will be sampled during this round. After development of the multiport system is complete, one round of samples will be collected.

Sampling will occur a minimum of two weeks after development of the multiport system. Sampling will be performed in accordance with the manufacturer's sampling procedures for the specific multiport system that is installed. Sampling procedures will be provided in the QAPP.

Groundwater samples will be analyzed for LDL VOCs, TCL SVOCs, pesticides/PCBs, and TAL inorganics. To support evaluation of natural attenuation of VOCs in groundwater, samples will be analyzed for the following parameters: chloride, methane, ethane, ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, and TOC (EPA, 1999a). Samples will also be analyzed for water quality parameters including TSS, TDS, alkalinity, ammonia, hardness, and TKN. Dissolved oxygen, oxidation-reduction potential (as Eh), turbidity, temperature, ferrous iron and conductivity will be measured in the field. A flow-through cell will be used when measuring oxygen-sensitive field parameters.

5.3.5.1.2 Stage II Multiport Monitoring Well Sampling (Rounds 2 and 3)
It is assumed that multiport monitoring wells will be installed in three boreholes drilled during Stage II. For cost estimating purposes it is assumed that up to four zones will be monitored in each well, for a total of 12 monitoring zones. After the development of the Stage II multiport system is complete, two rounds of groundwater samples will be collected. It is assumed that Round 2 will include the Stage I and Stage II multiport wells: Eight Stage I wells with 42 ports total (42 samples) and three Stage II wells with four ports in each well (12 samples) for a total of 54 samples in Round 2. Round 3 groundwater samples will be collected from the three multiport wells installed in Stage II to confirm the results of the Round 2 sampling and will be collected 8 weeks after Round 2.

Sampling will occur a minimum of two weeks after development of the multiport system. Sampling will be performed in accordance with the manufacturer's sampling procedures for the specific multiport system that is installed. Sampling procedures will be provided in the QAPP.

Groundwater samples will be analyzed for LDL VOCs, TCL SVOCs, pesticides/PCBs, and TAL inorganics. To support evaluation of natural attenuation of VOCs in groundwater, samples will be analyzed for the following parameters: chloride, methane, ethane, ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, and TOC (EPA, 1999a). Samples will also be analyzed for water quality parameters including TSS, TDS, alkalinity, ammonia, hardness, and TKN. DO, Eh, turbidity, temperature, ferrous iron and conductivity will be measured in the field. A flow-through cell will be used when measuring oxygen sensitive field parameters.

5.3.5.2 Surface Water and Sediment Sampling

As part of the Stage II investigation, surface water and sediment samples will be collected to characterize the nature and extent of contamination in order to support RI and ecological and human health risk assessments. Since the site is currently identified as a groundwater plume with an unknown source (EPA 2003b), the major pathway for contamination of surface water and sediment is via discharge of contaminated groundwater to the water bodies. Accordingly, the surface water and sediment program focuses on those areas where contaminated groundwater is expected to discharge.

One round of surface water and sediment samples will be collected during Stage II. It is assumed that 10 surface water and 10 sediment samples will be collected from areas where groundwater discharges to surface water. The locations of these samples will be determined after the groundwater/surface water interaction is evaluated in Stage II of this investigation. Specific locations of the surface water and sediment samples in the field will be based on actual field conditions (such as amount of sediment available) and biased towards sedimentation locations (such as the slower flowing portions or the inside of stream bends, where lower flow velocities promote sediment deposition).

Sediment samples will be collected from a depth of 0 to 6 inches. Both surface water and sediment samples will be collected using EPA approved methodologies which will be fully detailed in the QAPP.

Surface water samples collected from the above locations will be analyzed for LDL VOCs, TCL SVOCs, pesticides/PCBs, and TAL metals, alkalinity, ammonia, hardness, nitrate/nitrite, TKN, sulfate, sulfide, chloride, pH, TOC, TDS, and TSS. In addition, CDM will collect field measurements including temperature, conductivity, pH, turbidity, DO, and redox potential (as Eh) at each surface water sampling location.

Sediment samples will be analyzed for full TCL/TAL parameters, grain size, pH, and TOC.

5.3.5.3 Sub-Slab and Indoor Air Samples

There is a potential for VOC vapors from the groundwater plume to migrate to structures above the plume and affect indoor air quality. Vapor intrusion is assessed by collecting sub-slab air samples (below basements or foundation slabs) and air samples from interior spaces of residences or other structures. Currently, information about the depth and lateral extent of the plume and the nature of materials between the groundwater plume and the surface are not known. The location of the contaminant source or sources are currently unknown and the specific contaminants to target for sub-slab and vapor sampling have not been defined.

No sub-slab or indoor air sampling is planned at the current time. The HHRA (Section 5.7.2) will use data collected from the RI to model the potential for vapor intrusion from groundwater and soil contamination. In addition, the RI data will provide information on the nature and extent of groundwater and soil contamination including depth and lateral extent of the plume and contaminated soil. This data will provide a basis to assess the need for and extent of vapor intrusion sampling.

5.3.6 Ecological Characterization

An ecological characterization of the site will be conducted to describe existing conditions relative to vegetation community structure, wildlife utilization, and sensitive resources such as surface waters and wetlands. Based on the current understanding of the site contamination and the existing CSM, much of the contamination occurs in groundwater and is not available to ecological receptors. Potential impact to ecological receptors occurs only in areas where groundwater discharges to water bodies, which will be determined during the Stage II investigation.

The ecological characterization will be limited to these areas where potential groundwater discharge may occur. It will consist of a review of existing information, an ecological field investigation, and identification of threatened/endangered species and critical habitats.

Critical habitat is defined in the Endangered Species Act as:

(i) the specific areas within the geographical area currently occupied by a species, at the time it is listed in accordance with Section 4 of the Act, on which are found those physical or biological features (a) essential to the conservation of the species, and (b) which may require special management considerations or protection, and

(ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species.

5.3.6.1 Ecological Field Investigation

The ecological field investigation will be conducted to characterize the terrestrial and aquatic communities associated with groundwater discharge areas. Habitat conditions will be visually inspected by walking the site and recording observations of species composition and relative diversity and abundance, habitat association, and surface water conditions. Field observations will be recorded in logbooks and photographs will be taken to record both representative and unusual site conditions that would influence conclusions regarding potential contamination pathways, food chain effects, receptor identification, and risks to floral and faunal communities. The following information will be gathered during the field survey:

- General aquatic habitat conditions (e.g., water velocity, bottom substrate, channel width, channel depth, and extent of bank vegetation cover) along the water bodies. The Physical Characterization/Water Quality Field Data Sheet and the Habitat Assessment Field Data Sheet included in EPA's *Rapid*

Bioassessment Protocols for Use in Streams and Rivers (EPA 1989b) may be used as tools to complete the characterization of the aquatic habitats.

- Vegetation community/cover types and observed vegetative species makeup of each community, including dominant species and general observation of abundance and diversity within each cover type, at and in areas related to the site.
- Wildlife use observations including wildlife habitats, species, wildlife concentrations areas, and habitat use activities.
- General surficial soil conditions.
- Indications of environmental stress that could be related to site contaminants.

An ecological description will be prepared for the RI report and/or SLERA that discusses the vegetative communities, wildlife habitats, suspected surface water drainage pathways, and observed areas of environmental stress or disturbance. The following information will also be prepared and presented: observed potential surficial migration pathways; vegetation communities and composition; observed terrestrial and aquatic wildlife habitats; observed and expected wildlife utilization of the site; potential occurrence of state and federal threatened, endangered, or rare species and critical habitats; and observed ecological impairments.

5.3.6.2 Identification of Endangered and Special Concern Species

The Endangered Species Act endeavors to conserve ecosystems inhabited by endangered or threatened species, and to protect the species themselves. The presence of any State or federal threatened or endangered wildlife or plant species, or significant habitats at the site or surrounding area will be determined. EPA and the Puerto Rico Department of Natural Resources will be consulted to aid in this determination. Written communication from these agencies will be presented in the ecological risk assessment report.

Habitats essential to the growth and survival of rare plants and animals are considered critical habitats. Site walks conducted during the ecological characterization will identify critical habitats and the presence of these habitats will be noted in field logbooks. In addition, impairment (stressed vegetation, single species habitat) of critical habitats will be noted in field logbooks.

5.3.7 Geotechnical Survey

This subtask will not be utilized for this work assignment.

5.3.8 Disposal of Field Generated Waste

A subcontractor will be procured that will be responsible for the removal and proper disposal of all IDW, including drilling cuttings, waste soils, liquids, solids, and personal protective equipment. Representative waste samples will be collected and analyzed by a laboratory to characterize the waste. A technical statement of work will be prepared for the procurement of the waste hauling and disposal subcontractor under Subtask 5.1.11. Field oversight and health and safety monitoring will be conducted during all waste disposal field activities.

5.4 Task 4 - Sample Analysis

Section 5.3 and Table 5-1 specify the analyses for each type of samples. Details are summarized below.

- Industrial and Inactive Public Supply Wells: Groundwater will be sampled for LDL VOCs, TCL SVOCs, pesticides/PCBs, and TAL metals, chloride, methane, ethane, ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, TOC, TSS, TDS, ammonia, hardness, and TKN.

- Packer Samples: Packer samples will be analyzed for LDL VOCs, with 24-hour turnaround time for faxed results.

- Industrial Facilities Source Area Investigation Samples: Surface and subsurface soil samples will be analyzed for full TCL/TAL parameters, pH and TOC. Half of the samples will be sent for grain size distribution analysis.

- Current and Former Dry Cleaner Source Area Investigation Samples: Surface and subsurface soil samples will be analyzed for full TCL/TAL parameters, pH, TOC, and grain size distribution analysis.

- Stage Ib Multiport Monitoring Well Samples: Groundwater samples will be analyzed for LDL VOCs, TCL SVOCs, pesticides/PCBs, and TAL inorganics, chloride, methane, ethane, ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, TOC, TSS, TDS, ammonia, hardness, and TKN.

- Stage II Multiport Monitoring Well Samples: Groundwater samples will be analyzed for LDL VOCs, TCL SVOCs, pesticides/PCBs, and TAL inorganics, chloride, methane, ethane, ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, TOC, TSS, TDS, ammonia, hardness, and TKN.

- Surface Water Samples: Surface water samples analyzed through the CLP for full TCL SVOCs, pesticides/PCBs, TAL parameters, LDL VOCs, alkalinity, ammonia, hardness, nitrate/nitrite, TKN, sulfate, sulfide, chloride, pH, TOC, TDS, and TSS.

- Sediment Samples: Sediment samples will be analyzed for full TCL/TAL parameters, grain size, pH, and TOC.

5.4.1 Innovative Methods/Field Screening Sample Analysis

This subtask is not applicable to the remedial investigation.

5.4.2 Analytical Services Provided via CLP or DESA

RAS samples will be analyzed in compliance with the FASTAC Policy. CDM will pursue the use of the CLP or DESA and alternatives to standard CLP analysis will be sought with the EPA Regional Sample Control Coordinator (RSCC), prior to any sample collection activities and analyses via subcontract RAC II basic ordering agreement (BOA) laboratory. Under the CLP "flexibility clause" modifications are often made to CLP SOWs, enabling achievement of method detection limits (MDLs) that may meet the stated criteria.

CDM will implement the EPA Region 2 policy as shown below:

Tier 1:	DESA Laboratory (including Environmental Services Assistance Team (ESAT) support)
Tier 2:	EPA CLP
Tier 3:	Region specific analytical services contracts or use CLP flex clause
Tier 4:	Obtaining analytical services using subcontractors via field contracts (such as the RAC II BOA subcontractors)

All fixed laboratory analytical needs will to be submitted to the EPA RSCC regardless of the EPA or CLP laboratories' ability to perform. CDM will utilize the RAC II laboratory BOA only in the event that the first three tiers are not available.

5.4.3 Subcontractor Laboratory for Non-RAS Analyses

CDM has procured subcontract laboratories for analysis of non-RAS samples, including fast turnaround (24 hour) low detection limit VOCs. If DESA does not have capacity to analyze the non-RAS parameters listed in Section 5.4, the samples will be analyzed by a RAC II BOA subcontract laboratory.

CDM will select laboratory subcontractors from BOA based on the ability to meet analytical QA and QC requirements in the project-specific statements of work for non-RAS analytical services. The laboratory subcontractor will be selected by EPA-approved criteria and will follow the most current EPA protocols and Region II QA requirements. The CDM RQAC will ensure that the laboratory meets all EPA requirements for laboratory services. Project-specific SOWs govern the analytical work performed by the BOA laboratory subcontractors. CDM has provided EPA with copies of the QA manuals and/or QA plans of the BOA subcontract laboratories. CDM will monitor the subcontractor laboratory's analytical performance. The number of samples and analytical parameters are defined on Table 5-1. The analytical test methods, levels of detection, holding times, parameters, field sample preservation and QC samples will be provided in the QAPP.

5.5 Task 5 - Analytical Support and Data Validation

CDM will validate any non-RAS environmental samples analyzed by the subcontract laboratory. EPA or DESA will validate all other analytical data for the RI investigation.

5.5.1 Collect, Prepare and Ship Samples

Sample preparation and shipment is included under Task 3.

5.5.2 Sample Management

The CDM Analytical Services Coordinator (ASC) will be responsible for all RAS CLP laboratory bookings and coordination with the Sample Management Office (SMO), RSCC, DESA, and/or other EPA sample management offices for sample tracking prior to and after sampling events.

For all RAS activities, CDM will notify the Contract Laboratory Analytical Support Services (CLASS) to enable them to track the shipment of samples from the field to the laboratories and to ensure timely laboratory receipt of samples. Sample trip reports will be sent directly to the RSCC and the EPA RPM within 7 working days of final sample shipment, with a copy sent to the CDM ASC.

The CLP laboratories will be responsible for providing organic and inorganic analytical data packages to EPA for data validation.

Samples analyzed by the DESA laboratory and/or the subcontract laboratory will be coordinated by the ASC. All analytical data packages from the subcontract laboratory will be sent directly to CDM for data validation. If requested, CDM will send these validated data packages to EPA for QA review purposes. The data will be delivered in a format conducive to database input. CDM will provide the subcontract laboratory with a format for the electronic data deliverable.

5.5.3 Data Validation

All RAS samples will be analyzed by a laboratory participating in the CLP and all analytical data will be validated by EPA. The non-RAS data will be validated by CDM validators, who will use the requirements and the quality control procedures outlined in the associated methods and as per the analytical SOW for the laboratory subcontractor. The validation will determine the usability of the data. All validated data results will be presented in an appendix to the RI report. A data validation report summarizing the results of data validation will be submitted to EPA after all data have been validated.

Data validation will verify that the analytical results were obtained following the protocols specified in the CLP SOW, and are of sufficient quality to be relied upon to prepare an HHRA, an RI report, and to support a ROD.

The packer samples will not be validated.

5.6 Task 6 - Data Evaluation

This task includes efforts related to the compilation of analytical and field data. CDM will evaluate the usability of the EPA ESI data (EPA 2003a) for use in the RI report and risk assessments. All validated and unvalidated data will be entered into a relational database that will serve as a repository for data analysis, risk assessment, geographic information system (GIS), and data visualization. Environmental Quality Information Systems (EQuIS) will be used as the database. Tables, figures, and maps will be generated from the data to support preparation of the data evaluation report, the RI report, the HHRA report, the SLERA report, and the FS report. The data will be reviewed and carefully evaluated to identify the nature and extent of site-related contamination.

5.6.1 Data Usability Evaluation

CDM will evaluate the usability of data collected during the RI, including any uncertainties associated with the data. Previous investigations had different goals than the RI/FS that may influence the extent to which some of the data should be used in the RI/FS or risk assessments. Field sampling techniques, laboratory analytical techniques, and data validation should all be considered. Data usability will be evaluated against DQOs for the RI and for the risk assessments, as identified in the QAPP, prior to use in these reports. Any qualifications to the data usability will be discussed in the quality assurance section of any reports presenting data.

5.6.2 Data Reduction, Tabulation and Evaluation

CDM will evaluate, interpret, and tabulate data in an appropriate presentation format for final data tables. The following will be used as general guidelines in the preparation of data for use in the various reports.

- Tables of analytical results will be organized in a logical manner such as by sample location number, sampling zone, or some other logical format.
- Analytical results will not be organized by laboratory identification numbers because these numbers do not correspond to those used on sample location maps. The sample location/well identification number will always be used as the primary reference for the analytical results. The sample location number will also be indicated if the laboratory sample identification number is used.
- Analytical tables will indicate the sample collection dates.
- The detection limit will be indicated in instances where a parameter was not detected.
- Analytical results will be reported in the text, tables and figures using a consistent and conventional unit of measurement such as micrograms/liter for groundwater analyses and milligrams/kilogram for sediment analyses.
- EPA's protocol for eliminating field sample analytical results based on laboratory/field blank contamination results will be clearly explained.
- If the reported result has passed established data validation procedures without rejection, it will be considered valid.

- Field equipment rinsate blank analytical results will be discussed in detail if decontamination solvents are believed to have contaminated field samples.

Detailed information concerning the hydrogeological and physical characteristics of the site and the surrounding area will be gathered, reviewed, and evaluated for inclusion in the data evaluation report, the RI report, the RA reports, and the FS report. The purpose of these activities will be to provide a detailed understanding of the site physical features and to assess how these features may affect contaminant source areas, potential migration pathways, and potential remedial alternatives.

Database Management
CDM will use a relational environmental database and standard industry spreadsheet software programs to manage all data related to the sampling program. The system will provide data storage, retrieval, and analysis capabilities, and be able to interface with a variety of spreadsheet, word processing, statistical, GIS, and graphics software packages to meet the full range of site and media sampling requirements necessary for this work assignment.

Data collected during the RI will be organized, formatted, and input into the database for use in the data evaluation phase. All data entry will be checked for quality control throughout the multiple phases of the project. Data tables comparing the results of the various sampling efforts will be prepared and evaluated. Data tables will also be prepared that compare analytical results with both state and federal ARARs. Electronic data submitted will comply with EPA's Electronic Data Deliverable requirements.

Data Mapping
CDM will create a GIS in order to facilitate spatial analysis of the data and to generate figures for reports and presentations. The GIS will have geographic base layers consisting of various kinds of maps that depict regional and local physiographic features such as roads, buildings, water bodies, railroads, and topography. Site-specific features derived from the site and study area survey results will be added to complete the base layers. As samples are collected and wells are installed, the locations will be registered in the GIS. Historical and current analytical results for each sample location will be added, creating the capability to conduct functional spatial queries of the data to show where parameters of interest are sampled, detected, and exceed regulatory standards or criteria, by date and depth. This functionality will be used to support data interpretation for preparation of the RI report.

The GIS will also serve as the primary platform for figure and map generation to support both the RI and FS reports and presentations such as public meetings. Figures will be generated in plan view and cross section to show the extent of groundwater contamination. Graphic illustrations in the data evaluation report and/or the RI report will include geological profiles, cross-sections, water table maps, contaminant isoconcentration maps, and longitudinal and cross-sectional profiles of groundwater contamination. Plan view maps and figures will be generated using GIS to facilitate plan-view spatial data analysis. Figures will be generated to illustrate site features, historical sample locations, historical sampling results, current sample locations, current sampling results, locations where groundwater quality exceeds regulatory standards and criteria, and monitored natural attenuation (MNA) parameter concentrations relative to contaminant concentrations.

5.6.3 Modeling

Groundwater modeling is not required by EPA at this time. If during the course of this RI/FS a modeling effort is requested by EPA, EPA will issue an amendment to this work assignment. CDM will then perform an initial assessment and submit recommendations to EPA.

For the initial modeling assessment, relevant and available site data will be reviewed, including technical documents/reports and raw data from adjacent (and offsite) areas that may be within the anticipated model domain. Some of the analytical work required to make the assessment will already have been carried out during the RI. The initial modeling assessment will include the following activities:

- Review of:
  - Regional hydrogeological setting of the site
  - Site-specific data:
    - Nature and extent of contamination
    - Hydraulic properties of the aquifer(s)
    - Geometry and lithology of the aquifer(s)
  - Potential model boundaries and boundary conditions
  - Data accuracy and adequacy

- Preparation of recommendations section

Until the initial data review and modeling assessment is carried out, definition of a technical approach for site modeling is considered to be premature. If EPA concurs with any recommendations for modeling, then a detailed work plan and an associated modeling budget will be prepared for EPA's review. This work plan would detail the technical approach and outline specific tasks to be carried out. It would also provide a preliminary conceptual model of the site that would serve as the basis for model development.

5.6.4 Technical Memoranda

One technical meeting will be held and two technical memoranda will be prepared, as follows:

Results of Stage Ia Activities

CDM will prepare for and attend a technical meeting with EPA at the conclusion of the Stage Ia field investigation. At the meeting, CDM will present the data collected in Stage Ia and provide recommendations for Stage Ib activities. After the meeting, CDM will prepare a technical letter report defining the conclusions of the meeting. Details of the data presentation at the technical meeting and subsequent letter report are discussed in Section 5.3.3.1.6.

Results of Stage Ib Activities
A technical memorandum will be prepared at the conclusion of the Stage Ib investigation. The technical memorandum will include a more comprehensive data summary of the data previously outlined in the technical letter report, prepared at the conclusion of the Stage Ia. The primary objectives of this technical memorandum are to: summarize the data collected during Stage I, develop a detailed site conceptual model, and identify potential contaminant source areas or facilities. In addition, this technical memorandum will provide recommendations and the rationale for the Stage II activities to define the full nature and extent of contamination, including the following:

- Location and placement of additional multiport monitoring wells (if needed)
- Additional borehole logging activities (if needed)
- Additional packer sampling and packer testing activities (if needed)
- Additional source area soil sampling (if needed)
- Locations for groundwater/surface water interaction evaluation
- Locations for surface water and sediment samples

Data Evaluation Report
Upon completion and evaluation of all RI field activities, CDM will prepare and submit a Data Evaluation Report for review and approval by the EPA RPM. Upon approval by the EPA RPM, CDM will commence the draft RI report.

5.7 Task 7 - Assessment of Risk
CDM will conduct a baseline HHRA and a SLERA for the Cidra site. The objective of the risk assessments is to provide an evaluation of potential threats to human health and the environment that could occur from contaminants originating from the site in the absence of any remedial action. The risk assessments also provide the basis for determining whether or not remedial action is necessary and the justification for performing remedial actions.

5.7.1 Human Health Risk Assessment
The baseline HHRA will determine the potential adverse human health effects that could occur from contaminants originating from the site, in the absence of any actions to control or mitigate the releases. If the HHRA determines that potential adverse health effects exist and remediation is warranted, the HHRA will be used to focus remediation on the contaminated media and exposure pathways posing the greatest risk. Furthermore, the HHRA can be utilized to compare the potential health impacts of various remedial alternatives.

The HHRA will be performed in accordance with EPA guidance set forth in the following documents:

- *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A* (EPA 1989a)

- *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part B, Development of Risk Based Preliminary Remediation Goals* (EPA 1991a)
- *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments* (EPA 2001a)
- *Risk Assessment Guidance for Superfund: Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment Interim Final* (EPA 1999b)
- *Exposure Factors Handbook, Vol I, II and III* (EPA 1997a)
- *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors* (EPA 1991b)
- *Final Guidance for Data Usability in Risk Assessment* (EPA 1992a)
- *Health Effects Assessment Summary Tables FY-1997 Annual* (EPA 1997b)
- *Integrated Risk Information System (IRIS) (on-line data base of toxicity measures)* (most current version)
- *EPA Region 9 Preliminary Remediation Goals* (EPA 2004b or most current version)

Additional guidance which addresses site-specific issues and chemical contaminants will also be consulted.

CDM will evaluate key contaminants identified in the HHRA for receptor exposure and perform an estimate of the level of key contaminants reaching human receptors. CDM will use EPA's standardized planning and reporting methods as outlined in EPA's Risk Assessment Guidance for Superfund (RAGS Part D).

The following activities under this subtask will form the basis for the HHRA.

5.7.1.1 Draft Human Health Risk Assessment Report

The draft baseline human health risk assessment report will be submitted after EPA has approved the PAR, described in Section 5.1.13. The draft HHRA report will cover the following:

Hazard Identification

CDM will review available information on the hazardous substances present at the site, and identify the COPCs. The COPCs to be used in the risk assessment will be selected in accordance with EPA Region 2 procedures as presented in RAGS Part A. Additional selection criteria that will be used to identify the COPCs at the site include the following:

- Frequency of detection in analyzed environmental medium (e.g., groundwater)

- Historical site information/activities (i.e., site-related)
- Chemical concentration relative to upgradient and background concentrations
- Chemical toxicity (potential carcinogenic and noncarcinogenic effects, weight of evidence for potential carcinogenicity)
- Chemical properties (e.g., mobility, persistence and bioaccumulation)
- Significant exposure routes
- Risk-based concentration screen using EPA Region 9 Risk Based Concentrations and media specific chemical concentrations (i.e., maximum detected concentrations)

In general, nutrients such as calcium, magnesium, potassium, and sodium are not quantitatively evaluated in the risk assessment.

Statistical analysis of the data will be performed (i.e., tests for distribution, calculation of upper confidence levels [UCLs]).

Toxicity Assessment

The toxicological properties of the selected COPCs using the most current toxicological human health effects data will be presented. Chemicals that cannot be quantitatively evaluated due to a lack of toxicity values will not be eliminated as COPCs on this basis. These chemicals will instead be qualitatively addressed for consideration in risk management decisions for the site.

Toxicity values and toxicological information regarding the potential for carcinogens and non-carcinogens to cause adverse health effects in humans will be obtained from the hierarchy of EPA sources in accordance with EPA OSWER Directive 9285.7-53 (EPA 2003). The primary source will be EPA's IRIS on-line database, which is updated regularly, provides chemical-specific toxicity values and toxicological information that have undergone peer review and represent an EPA scientific consensus. If toxicity values are not available from IRIS, the EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) will be consulted. PPRTVs are developed by EPA's Office of Research and Development/National Center for Environmental Assessment/Superfund Health Risk Technical Support Center (STSC) on a chemical specific basis when requested by EPA's Superfund program. If no toxicity values are available from PPRTVs, then other sources such as the most recent Health Effects Assessment Summary Tables (HEAST) will be used to select toxicity values.

Toxicity values include slope factors for carcinogens and reference doses (RfDs) and reference concentrations (RfCs) for non-carcinogens. In the HHRA, a slope factor, expressed in the unit of milligrams per kilogram per day $(mg/kg/day)^{-1}$, is used to estimate an upper-bound probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a potential carcinogen.

For the evaluation of non-carcinogenic health effects in the risk assessment, chronic and subchronic RfDs or RfCs are used. A chronic RfD or RfC is an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without appreciable risk of deleterious effects during a lifetime. Chronic RfDs or RfCs are generally used to evaluate the potential non-carcinogenic health effects associated with exposure periods between six years and a lifetime. Subchronic RfDs or RfCs aid in the characterization of potential non-cancer effects associated with shorter-term exposure (i.e., less than six years).

Toxicity endpoints/target organs for non-carcinogenic COPCs will be presented for those chemicals showing hazard quotients greater than one. If the hazard index is greater than one due to the summing of hazard quotients, segregation of the hazard index by critical effect and mechanism of action will be performed as appropriate.

Exposure Assessment

Exposure assessment involves the identification of the potential human exposure pathways at the site for present and potential future land-use scenarios. Potential release and transport mechanisms will be identified for contaminated source media. Exposure pathways will also be identified that link the sources, locations, types of environmental releases, and environmental fate with receptor locations and activity patterns. An exposure pathway is considered complete if it consists of the following elements:

- A source and mechanism of release
- A transport medium
- An exposure point (i.e., point of potential contact with a contaminated medium)
- An exposure route (e.g., ingestion) at the exposure point

All exposure pathways under the current and future land-use scenarios will be presented; however, only some may be selected for quantitative analysis. Justifications will be provided for those exposure pathways retained and for those eliminated.

Based on the initial site visit to the Cidra site and information regarding current and future land use, the potential receptors under the current land-use scenario may include residents (adults and children) and workers. If the investigation shows that the contaminated groundwater discharges into surface water in the vicinity of the site, then recreational users will also be included. For the future land-use scenario, in addition to residents (adults and children), workers, and possible recreational users, construction workers will be included. The potential exposure pathways for each receptor are listed below.

- Residents (Adults and Children)
  Surface soil
  - Incidental Ingestion
  - Incidental Dermal contact
  - Inhalation of fugitive dust

Groundwater
- Ingestion
- Dermal contact
- Inhalation of volatiles while showering

Indoor Air vapors
- Inhalation of volatiles

■ Workers (Adults)

Surface soil
- Incidental Ingestion
- Incidental Dermal contact
- Inhalation of fugitive dust

Groundwater
- Ingestion
- Dermal contact

Indoor Air vapors
- Inhalation of volatiles

■ Recreational Users (Adults and Children) - only if the investigation data show that the contaminated groundwater discharges to surface water in the vicinity of the site

Surface Water
- Incidental ingestion
- Dermal contact

Sediment
- Incidental ingestion
- Dermal contact

Fish Consumption

■ Construction Workers *(Adults)*

Surface/subsurface soil
- Incidental ingestion
- Incidental dermal contact
- Inhalation of fugitive dust

Groundwater
- Ingestion
- Dermal contact

Exposure point concentrations will be developed for each COPC in the risk assessment, for use in the calculation of daily intakes. The concentration is the 95 percent UCL on the arithmetic mean, or the maximum detected value (whichever is lower).

Chronic daily intakes, expressed as mg/kg-day, will be calculated and used in conjunction with toxicity values to provide quantitative estimates of carcinogenic risk and non-carcinogenic health effects.

Exposure assumptions used in chronic daily intake calculations will be based on information contained in EPA guidance, site-specific information, and professional judgement. These assumptions are generally 90th and 95th percentile parameters, which represent the reasonable maximum exposure (RME). The RME is the highest exposure that is reasonably expected to occur at a site. If potential risks and hazards exceed EPA target levels, then Central Tendency Exposures (CTE) will be evaluated using 50th percentile exposure variables.

The exposure assessment will identify the magnitude of actual or potential human exposures, the frequency and duration of these exposures, and the routes by which receptors are exposed. The assumptions will include information from the Standard Default Assumptions Guidance and the Exposure Factors Handbook (EPA 1997a). Site specific information will be used where appropriate to verify or refine these assumptions. In developing the exposure assessment, CDM will develop reasonable maximum estimates of exposure for both current land-use conditions and potential future land-use conditions at the site.

Risk Characterization

In this section on the risk assessment, toxicity and exposure assessments will be integrated into quantitative and qualitative expressions of carcinogenic risk and non-carcinogenic hazards.

Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a life time as a result of exposure to a potential carcinogen. Per RAGS, the slope factor directly converts estimated daily intakes averaged over a lifetime to incremental risk of an individual developing cancer. This carcinogenic risk estimate is generally an upper-bound value since the slope factor is often an upper 95th percentile confidence limit of probability of response based on experimental animal data used in the multistage model.

The potential for non-cancer effects will be evaluated by comparing an exposure level over a specified time period with a reference dose derived for a similar exposure period. This ratio of exposure to toxicity is referred to as a hazard quotient. This hazard quotient assumes that there is a level of exposure below which it is unlikely even for sensitive populations to experience adverse health effects; however, this value should not be interpreted as a probability. Generally, the greater the hazard quotient is above unity, the greater the level of concern.

Carcinogenic risks and non-carcinogenic hazard index (HI) values will be combined across chemicals and exposure pathways as appropriate. EPA recommends a target value or risk range (i.e., HI = 1 for non-carcinogenic effects or carcinogenic risk = 1×10^{-4} to 1×10^{-6}) as threshold values for potential human health impacts. The results presented in the spreadsheet calculations will be compared to these target levels and discussed. Characterization of the potential risks associated with the site provides the EPA risk manager with a basis for determining whether additional response action is necessary at the site and a basis for determining residual chemical levels that are adequately protective of human health.

Identification of Limitations/Uncertainties

In any risk assessment, estimates of potential carcinogenic risk and non-carcinogenic health effects have numerous associated uncertainties. The primary areas of uncertainty and limitations will be qualitatively discussed. Quantitative measures of uncertainty will involve the calculation of central tendencies. Central tendency evaluation involves the use of 50^{th} percentile input parameters in risk and hazard estimates as opposed to 90^{th} or 95^{th} percentile parameters used in the RME calculations. The 50^{th} percentile parameters are considered representative of the general receptor population, but may underestimate the health risk to sensitive receptors. The chemicals driving the risk assessment will be evaluated using these average exposure assumptions and the 95 percent UCL concentrations. The central tendency risks will be discussed in relation to RME risks. Central tendency analyses will only be calculated for pathways in which RME risks are considered above *de minimus* levels (carcinogenic risk above 1×10^{-6} and/or HI above 1.0).

The CDM SM will coordinate with the EPA RPM and submit draft/interim deliverables as outlined in the Risk Assessment Guidance for Superfund - Part D. All data will be presented in RAGS Part D Format. The draft HHRA report will provide adequate details of the activities and be presented so that individuals not familiar with risk assessment can easily follow the procedures.

5.7.1.2 Final Human Health Risk Assessment Report

CDM will submit the final human health risk assessment report, incorporating EPA review comments.

5.7.2 Screening Level Ecological Risk Assessment

If the data from the investigation indicates that contaminated groundwater discharges to surface water in the vicinity of the site, then CDM will conduct a SLERA. The SLERA will utilize surface water and sediment data generated from the RI at the site. The SLERA will address the potential risks to sensitive ecological receptors from site contaminants in surface water and sediments at the site, in areas identified as likely to receive discharge from site groundwater.

This assessment will be prepared in accordance with the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (Interim Final)* (EPA 1997c) and *Guidelines for Ecological Risk Assessment* (EPA 1998a).

5.7.2.1 Draft Ecological Risk Assessment Technical Memorandum

The draft ecological risk evaluation includes the preparation of a technical memorandum to present the comparison of surface water and sediment results to ecological benchmarks. It is assumed that groundwater discharges to surface water, and surface water and sediment samples will be collected. The technical memorandum will also include a recommendation for additional risk assessment activities, if the ecological benchmarks are exceeded.

Based on the preliminary site visit and available data of the site at the time of preparation of this document, it appears that the primary threat to ecological receptors is from discharge of VOCs in groundwater to surface water bodies. There are low levels of VOC contaminants in groundwater. Potential ecological threats are most likely to be low at the site.

The technical memorandum will include a brief summary of site history, environmental setting, and nature and extent of contamination.

In each environmental medium the maximum detected concentrations will be compared to the ecological screening benchmarks. Contaminants lacking screening levels will be retained for evaluation. Chemicals will not be eliminated from screening due to the chemical's frequency of detection or by comparison to background concentrations.

The surface water benchmarks used for comparison include National Recommended water Quality Criteria (EPA 2002) and Puerto Rico Water Quality Standards Regulation as Amended on March 2003 (PREQB 2003). The sediment benchmarks will be the Effect Range Low (LE-L) from Long and Morgan (1991).

5.7.2.2 Final Ecological Risk Assessment Technical Memorandum

CDM will submit the final technical memorandum to EPA, incorporating EPA's review and comments.

If the technical memorandum indicates the need for additional ecological investigation or risk assessment activities, and EPA agrees with the recommendation, a work plan letter will be prepared under Subtask 5.7.2.2. The work plan letter will outline the technical requirements to conduct further ecological investigations or risk assessment activities at the site and the associated costs for the work.

5.8 Task 8 - Treatability Studies/Pilot Testing

Applicable treatment technologies that may be suitable for the Cidra site will be identified to determine if there is a need to conduct treatability studies.

5.8.1 Literature Search

CDM will research viable technologies that may be applicable to the contaminants of concern and the site conditions encountered. Upon completion of the literature search, CDM will provide a technical memorandum to the EPA RPM that summarizes the results. As part of this document, CDM will submit a plan that recommends performance of a treatability study and identifies the types and specific goals of the study. The treatability study will be designed to determine the suitability of remedial technologies to site conditions and addressing the type of contamination that exists at the site. If directed by EPA, CDM will prepare an addendum to the RI/FS work plan for the treatability study. An addendum for a treatability study is not included in the current work plan.

5.8.2 Treatability Study Work Plan (Optional)

If requested by the EPA, CDM will perform the following:

- Prepare a draft addendum to the RI/FS work plan that describes the approach for performance of the treatability study
- Participate in negotiations to discuss the final technical approach and costs required to accomplish the treatability study requirements
- Prepare a final work plan addendum and supplemental budget that incorporates the agreements reached during the negotiations

The treatability study work plan addendum will describe the treatment process and how the proposed technology or vendor (if proprietary) will meet the performance standards for the site. The work plan addendum will address how the proposed technology or vendor will meet all discharge or disposal requirements for treated material, air, water, and expected effluents. The proposed treatment and disposal of all material generated during the treatability study will be addressed.

The treatability study work plan addendum will describe the technology to be tested, test objectives, test equipment or systems, experimental procedures, treatability conditions to be tested, measurements of performance, analytical methods, data management and analysis, health and safety procedures, and residual waste management. The DQOs for the treatability study will also be documented. If pilot-scale treatability studies are to be done, the treatability study work plan addendum will also describe pilot plant installation and startup, pilot plant operation and maintenance procedures, and operating conditions to be tested. If testing is to be performed off-site, permitting requirements will be addressed. A schedule for performing the treatability study will be included with specific durations and dates, when available, for each task and subtask, including anticipated EPA review periods. The schedule will also include key milestones for which completion dates should be specified. Such milestones are procurement of subcontractors, sample collection, sample analysis and preparation of the treatability study report.

5.8.3 Conduct Treatability Studies (Optional)

CDM will conduct the treatability study in accordance with the approved treatability study addendum to the RI/FS work plan, QAPP, and HSP, to determine whether the remediation technology or vendor of the technology can achieve the performance standards.

The following activities are to be performed, when applicable, as part of the performance of the treatability study and pilot testing:

- Procurement of Test Facility and Equipment - CDM will procure the test facility and equipment necessary to execute the tests.

- Procurement of Subcontractors - CDM will procure subcontractors as necessary for test/study performance.
- Test and Operate Equipment - CDM will test the equipment to ensure proper operation, and operate or oversee operation of the equipment during the testing.
- Retrieve Samples for Testing - CDM will obtain samples for testing as specified in the treatability study work plan.
- Perform Laboratory Analysis - CDM will establish a field laboratory to facilitate fast-turnaround analysis of test samples, if economically and technically feasible.
- Characterize and dispose of residual wastes.
- Evaluate the test results.

5.8.4 Treatability Study Report (Optional)

CDM will prepare and submit the treatability study evaluation report that describes the performance of the technology. The study results will clearly indicate the performance of the technology or vendor compared with the performance standards established for the site. The report will also evaluate the treatment technology's effectiveness, implementability, cost and final results compared with the predicted results. In addition, the report will evaluate full-scale application of the technology, including a sensitivity analysis that identifies the key parameters affecting full-scale operation.

5.9 Task 9- Remedial Investigation Report

CDM will develop and submit a remedial investigation report that accurately establishes site characteristics including the identification of contaminated media, definition of the extent of contamination in groundwater, soils, surface water, and sediments and delineation of the physical boundaries of contamination. CDM will obtain detailed sampling data to identify key contaminants and determine the movement and extent of contamination in the environment. Key contaminants will be identified in the report and will be selected based on toxicity, persistence, and mobility in the environment.

5.9.1 Draft Remedial Investigation Report

A draft RI report will be prepared in accordance with the format described in EPA guidance documents such as the "*Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*". A draft outline of the report, adapted from the 1988 guidance, is shown in Table 5-4. This outline should be considered a draft and subject to revision, based on the data obtained. EPA's SOW for this work assignment has provided a detailed description of the types of information, maps, and figures to be included in the RI report. CDM will incorporate such information to the fullest extent practicable.

Upon completion, the draft RI report will be submitted for review by a CDM Technical Review Committee (TRC), followed by a QA review. It will then be submitted to EPA for formal review and comment.

5.9.2 Final Remedial Investigation Report

Upon receipt of all EPA and other federal and Commonwealth written comments, CDM will develop responses to comments, and revise the report prior to submittal to EPA. When EPA determines that the report is acceptable, the report will be deemed the final RI report.

5.10 Task 10 - Remedial Alternatives Screening

This task covers activities for the development of appropriate remedial alternatives that will undergo full evaluation. A range of alternatives will be considered, including innovative treatment technologies, consistent with the regulations outlined in the NCP, 40 CFR Part 300, the "*Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*" *(OSWER Directive 9355.3-01 October 1988)* or latest version, and other OSWER directives including 9355.4-03, October 18, 1989, and 9283.1-06, May 27, 1992, "*Considerations in Ground Water Remediation at Superfund Sites*", as well as other applicable and more recent policies or guidance. CDM will also use EPA's 1996 final guidance *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites*, which describes strategies and technologies for groundwater contaminated with chlorinated solvents.

CDM will investigate alternatives that will remediate or control contaminated media related to the site, as defined in the RI, to provide adequate protection of human health and the environment. The potential alternatives will encompass, as appropriate, a range of alternatives in which treatment is used to reduce the toxicity, mobility, or volume of wastes but vary in the degree to which long-term management of residuals or untreated waste is required, and will include one or more alternatives involving containment with little or no treatment, as well as a no-action alternative.

Based on EPA's presumptive remedy guidance (1996), the following alternatives, composed of treatment technologies for potentially affected media at the site, may be selected as representative technologies in the FS alternatives if they are deemed appropriate for chlorinated VOCs.

Groundwater

- No Action
- Groundwater treatment with air stripping, granular activated carbon, chemical/ultraviolet oxidation, permeable reactive barriers (PRB), and/or anaerobic biological reactors
- Monitored natural attenuation

Additional technologies may be evaluated if extremely high levels of contamination (e.g., DNAPL) are identified. Groundwater remedial alternatives will also include several disposal options for treated groundwater (e.g., recharge basins, discharge to a surface water body).

Based on the established remedial response objectives and the results of the risk assessments (Task 7), the initial screening of remedial alternatives will be performed according to the procedures recommended in "*Interim Final Guidance for Conducting RI/FS under CERCLA*" (EPA 1988).

The alternatives will be screened qualitatively against three criteria: effectiveness, implementability, and relative cost. A brief description of the application of these criteria is as follows:

- Effectiveness - The evaluation focuses on the potential effectiveness of technologies in meeting the remedial action goals; the potential impacts to human health and the environment during construction and implementation; and how proven and reliable the process is with respect to the contaminants and conditions at the site.

- Implementability - This evaluation encompasses both the technical and administrative feasibility of the technology. It includes an evaluation of treatment requirements, waste management, and relative ease or difficulty in achieving the operation and maintenance requirements. Technologies that are clearly unworkable at the site are eliminated.

- Relative Cost - Both capital cost and operation and maintenance cost are considered. The cost analysis is based upon engineering judgement, and each technology is evaluated as to whether costs are high, moderate, or low relative to other options within the same category.

The screening evaluation will generally focus on the effectiveness criterion, with less emphasis on the implementability and relative cost criteria. Technologies surviving the screening process are those that are expected to achieve the remedial action objectives for the site, either alone or in combination with others.

5.10.1 Technical Memorandum

CDM will prepare a draft remedial alternatives screening memorandum that will document all of the analyses and evaluations described above. This draft memorandum will be submitted to EPA for formal review and comment and will:

- Establish Remedial Action Objectives - Based on existing information, CDM will identify site-specific remedial action objectives that should be developed to protect human health and the environment. The objectives will specify the contaminant(s) and media of concern, the exposure route(s) and receptor(s), and an acceptable contaminant level or range of levels for each exposure route (i.e., preliminary remediation goals).

- Establish General Response Actions - CDM will develop general response actions for each medium of interest by defining contaminant, treatment, excavation, pumping, or other actions, singly or in combination to satisfy remedial action objectives. The response actions will take into account requirements for protectiveness as identified in the remedial action objectives and the chemical and physical characteristics of the site.

- Identify and Screen Applicable Remedial Technologies - CDM will identify and screen technologies based on the general response actions. Hazardous waste treatment technologies will be identified and screened to ensure that only those technologies applicable to the contaminants present, their physical matrix, and other site characteristics will be considered. This screening will be based primarily on a technology's ability to address the contaminants at the site effectively, but will also take into account that technology's implementability and cost. CDM will select representative process options, as appropriate, to carry forward into alternative development and will identify the need for treatability testing for those technologies that are probable candidates for consideration during the detailed analysis.

- Develop Remedial Alternatives in accordance with the Nation Contingency Plan (NCP).

- Screen Remedial Alternatives for Effectiveness, Implementability, and Cost - CDM will screen alternatives to identify the potential technologies or process options that will be combined into media-specific or site-wide alternatives. The developed alternatives will be defined with respect to size and configuration of the representative process options, time for remediation, rates of flow or treatment, spatial requirements, distances for disposal, required permits, imposed limitations, and other factors necessary to evaluate the alternatives. If many distinct viable options are available and developed, CDM will screen the alternatives undergoing detailed analysis to provide the most promising process options.

The technical evaluations completed as part of this task will be summarized and presented to EPA in a technical meeting.

5.10.2 Final Technical Memorandum
As directed by EPA, this subtask is not applicable. EPA's review comments on the draft technical memorandum will be incorporated into the draft FS report under Section 5.12.1.

5.11 Task 11 - Remedial Alternatives Evaluation
Remedial technologies passing the initial screening process will be grouped into remedial alternatives. This task covers efforts associated with the assessment of individual alternatives against each of the nine current evaluation criteria and a comparative analysis of all options against the evaluation criteria. The analysis will be

consistent with the NCP, 40 CFR Part 300, and will consider the "*Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA*" (OSWER Directive 9355.3-01) and other pertinent OSWER guidance. The detailed evaluation criteria for remedial alternatives are listed on Table 5-5 and a brief description of each criterion is provided:

- <u>Overall Protection of Human Health and the Environment</u> - This criterion provides a final check to assess whether each alternative meets the requirement that it is protective of human health and the environment. The overall assessment of protection is based on a composite of factors assessed under the evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

- <u>Compliance with ARARs</u> - This criterion is used to determine how each alternative complies with applicable or relevant and appropriate Federal and State requirements, as defined in Section 121 of CERCLA 42 USC Section 9621.

- <u>Long-Term Effectiveness</u> - This criterion addresses the results of a remedial action in terms of the risk remaining at the site after the response objectives have been met. The primary focus of this evaluation is to determine the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes. The factors to be evaluated include the magnitude of remaining risk (measured by numerical standards such as cancer risk levels), and the adequacy, suitability and long-term reliability of management controls for providing continued protection from residuals (i.e., assessment of potential failure of the technical components).

- <u>Reduction of Toxicity, Mobility, or Volume</u> - This criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility or volume of the contaminants. The factors to be evaluated include the treatment process employed, the amount of hazardous material destroyed or treated, the degree of reduction expected in toxicity, mobility or volume, and the type and quantity of treatment residuals.

- <u>Short-Term Effectiveness</u> - This criterion addresses the effects of the alternative during the construction and implementation phase until the remedial actions have been completed and the selected level of protection has been achieved. Each alternative is evaluated with respect to its effects on the community and onsite workers during the remedial action, environmental impacts resulting from implementation, and the amount of time until protection is achieved.

- <u>Implementability</u> - This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. Technical feasibility considers construction and operational difficulties, reliability, ease of undertaking additional remedial action (if required), and the ability to monitor its effectiveness. Administrative feasibility considers activities needed to coordinate with other agencies (e.g., Commonwealth and local) in regard to obtaining permits or approvals for implementing remedial actions.

- Cost - This criterion addresses the capital costs, annual operation and maintenance costs, and present worth analysis. Capital costs consist of direct (construction) and indirect (non-construction and overhead) costs. Direct costs include expenditures for the equipment, labor and material necessary to perform remedial actions. Indirect costs include expenditures for engineering, financial and other services that are not part of actual installation activities but are required to complete the installation of remedial alternatives. Annual operation and maintenance costs are post-construction costs necessary to ensure the continued effectiveness of a remedial action. These costs will be estimated to provide an accuracy of +50 percent to -30 percent. A present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year, usually the current year. This allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that would be sufficient to cover all costs associated with the remedial action over its planned life.

- Commonwealth Acceptance - This criterion evaluates the technical and administrative issues and concerns the Commonwealth may have regarding each of the alternatives. The factors to be evaluated include those features of alternatives that the Commonwealth supports, reservations of the Commonwealth, and opposition of the Commonwealth.

- Community Acceptance - This criterion incorporates public concerns into the evaluation of the remedial alternatives. Often, community (and also Commonwealth) acceptance cannot be determined during development of the RI/FS. Evaluation of these criteria is postponed until the RI/FS report has been released for state and public review. These criteria are then addressed in the ROD and the responsiveness summary.

Each remedial alternative will be subject to a detailed analysis according to the above evaluation criteria. A comparative analysis of all alternatives will then be performed to evaluate the relative benefits and drawbacks of each according to the same criteria. A preferred remedial alternative will be recommended based upon the results of the comparative analysis.

5.11.1 Technical Memorandum

CDM will prepare a draft technical memorandum that addresses the following:

- A technical description of each alternative that outlines the waste management strategy involved and identifies the key ARARs associated with each alternative.

- A discussion that describes the performance of that alternative with respect to each of the evaluation criteria. A table will be provided summarizing the results of this analysis. Once the individual analysis is completed, a comparison and contrast of the alternatives to one another, with respect to each of the evaluation criteria, will be performed.

This draft memorandum will be submitted to EPA for formal review and comment. In addition, the technical evaluations completed as part of this task will be summarized and presented to EPA in a technical meeting.

5.11.2 Final Technical Memorandum

As directed by EPA, this subtask is not applicable. EPA's review comments on the draft technical memorandum will be incorporated into the draft FS report under Section 5.12.1.

5.12 Task 12 - Feasibility Study Report

CDM will develop a feasibility study report consisting of a detailed analysis of alternatives and a cost-effectiveness analysis, in accordance with the NCP, 40 CFR Part 300, as well as the most recent guidance.

5.12.1 Draft Feasibility Study Report

CDM will submit a draft feasibility study report to EPA that includes the following detailed information.

- Summarize the Remedial Investigation - CDM will summarize key elements of the RI including the nature and extent of contamination in all site media of concern, the fate and transport factors that affect the identified contamination, and the results of the site risk assessments.

- Establish Remedial Action Objectives - Based on existing information, CDM will identify site-specific remedial action objectives that will protect human health and the environment. The objectives will specify the contaminant(s) and media of concern, the exposure route(s) and receptor(s), and an acceptable contaminant level or range of levels for each exposure route (i.e., preliminary remediation goals).

- Establish General Response Actions - CDM will develop general response actions for each medium of interest by defining contaminant, treatment, excavation, pumping, or other actions, singly or in combination, to satisfy remedial action objectives. The response actions will take into account requirements for protectiveness as identified in the remedial action objectives and the chemical and physical characteristics of the site.

- Identify and Screen Applicable Remedial Technologies - CDM will identify and screen technologies based on the general response actions. Hazardous waste treatment technologies will be identified and screened to ensure that only those technologies applicable to the contaminants present, their physical matrix, and other site characteristics will be considered. This screening will be based primarily on a technology's ability to address the contaminants at the site effectively, but will also take into account that technology's implementability and cost. If applicable, CDM will develop an analytical flow model to support groundwater flow and plume capture model of the hydrogeologic system at the site and surrounding area. CDM will select representative process options, as appropriate, to carry forward into alternative development and will identify the need for treatability testing for those technologies that are probable candidates for consideration during the detailed analysis.

- Develop Remedial Alternatives in accordance with the NCP - CDM will assemble technologies into remedial alternatives to address the identified contamination at the site.

- Screen Remedial Alternatives for Effectiveness, implementability, and Cost - CDM will screen alternatives to identify the potential technologies or process options that will be combined into media-specific or site-wide alternatives. The developed alternatives will be defined with respect to size and configuration of the representative process options, time for remediation, rates of flow or treatment, spatial requirements, distances for disposal, required permits, imposed limitations, and other factors necessary to evaluate the alternatives. If many distinct viable options are available and developed, CDM will screen the alternatives undergoing detailed analysis to focus on the most promising process options.

- Develop Detailed Alternative Descriptions - CDM will develop detailed technical descriptions of each alternative that outlines the waste management strategy involved and identifies the key ARARs associated with each alternative.

- Screen Against Evaluation Criteria - CDM will present discussions that describe the performance of each alternative with respect to the evaluation criteria described in Section 5.11. The results of the analysis will be summarized in a table.

- Compare Alternatives - CDM will compare and contrast the alternatives to one another, with respect to each of the evaluation criteria.

The technical feasibility considerations will include the careful study of any problems that may prevent a remedial alternative from mitigating site problems. Therefore, the site characteristics from the RI will be kept in mind as the technical feasibility of the alternative is studied. Specific items to be addressed will be reliability (operation over time), safety, operation and maintenance, ease with which the alternative can be implemented, and time needed for implementation.

The FS report format is shown on Table 5-6 and will consist of an executive summary and five sections. The executive summary will be a brief overview of the FS and the analysis underlying the remedial actions that were evaluated. The five sections will be as follows:

- Introduction and Summary of the Remedial Investigation
- Identification and Screening of Remedial Technologies
- Development and Initial Screening of Remedial Alternatives
- Description and Detailed Analysis of Alternatives
- Comparative Analysis of Alternatives

The FS report will be reviewed by a CDM TRC. TRC comments will be addressed prior to submittal to EPA for review.

5.12.2 Final Feasibility Study Report

Upon receipt of all EPA and other federal and Commonwealth written comments, CDM will prepare a response to comments letter prior to revising the FS report for submittal to EPA. When EPA determines that the document is acceptable, the FS report will be deemed the final FS report.

5.13 Task 13 - Post RI/FS Support

In accordance with the SOW, this task is currently not applicable to this work assignment.

5.14 Task 14 - Negotiation Support

In accordance with the SOW, this task is currently not applicable to this work assignment.

5.15 Task 15 - Administrative Record

In accordance with the SOW, this task is currently not applicable to this work assignment.

5.16 Task 16 - Work Assignment Closeout

Project closeout includes work efforts related to the project completion and closeout phase. Project records will be transferred to EPA. A Work Assignment Closeout Report (WACR) will be completed.

5.16.1 Work Assignment Closeout Report

CDM will prepare a WACR that will include all level-of-effort hours, by professional level, and costs in accordance with the project work breakdown structure.

5.16.2 Document Indexing

CDM will organize the work assignment files in its possession in accordance with the currently approved file index structure.

5.16.3 Document Retention/Conversion

CDM will convert all pertinent paper files into an appropriate long-term storage format. EPA will define the specific long-term storage format prior to closeout of this work assignment.

Section 6
Schedule

A project schedule for the RI/FS is included as Figure 6-1. The project schedule is based on assumptions for durations and conditions of key events occurring on the critical and non-critical path. These assumptions are as follows:

- The schedule for the field activities is dependent on access to all properties being obtained by EPA without difficulty.
- Field activities will not be significantly delayed due to severe weather conditions (hurricanes).
- The schedule for the field activities is dependent on timely review and approval of the work plan and QAPP and the provision of adequate funding by EPA.
- The schedule for the field investigation is dependent on all field activities being performed in Level D or Level C health and safety protection.
- CDM will receive validated data for analyses performed by EPA's Contract Laboratory Program 8 weeks after sample collection.

Section 7
Project Management Approach

7.1 Organization and Approach

The proposed project organization is shown in Figure 7-1.

The SM, Mr. Michael Valentino, P.G., has primary responsibility for plan development and implementation of the RI, including coordination with the RI task managers and support staff, development of bid packages for subcontractor services, acquisition of engineering or specialized technical support, and all other aspects of the day-to-day activities associated with the project. The SM identifies staff requirements, directs and monitors site progress, ensures implementation of quality procedures and adherence to applicable codes and regulations, and is responsible for performance within the established budget and schedule.

The RI task manager, Ms. Nancy Rodriguez, reports to, and will work directly with the SM to develop and coordinate the work plan, QAPP, staffing and physical resource requirements, and technical statements of work for professional subcontractor services. She will be responsible for the implementation of the field investigation, performance tracking of the CDM subcontractor laboratory, the analysis, interpretation and presentation of data acquired relative to the site, preparation of the data evaluation summary report, and the RI report.

The FS task manager, Mr. Thomas Mathew, P.E., will work closely with the RI task manager to ensure that the field investigation generates the proper type and quantity of data for use in the initial screening of remedial technologies/alternatives, detailed evaluation of remedial alternatives, development of requirements for and evaluation of treatability study/pilot testing, if required, and associated cost analysis. The FS report will be developed by the FS technical group.

The field team leader (FTL), Mr. Hermes Chacon, is responsible for on-site management for the duration of all site operations including the activities conducted by CDM such as equipment mobilization, sampling, and the work performed by subcontractors such as surveying.

The RQAC is Ms. Jeniffer Oxford, who is responsible for overall project quality including development of the QAPP, review of specific task QA/QC procedures, and auditing of specific tasks. The RQAC reports to the CDM Quality Assurance Manager (QAM).

The RAC II QAM, Mr. Steve Martz, is responsible for overall quality for the RAC contract, and will have approved quality assurance coordinators (QACs) perform the required elements of the RAC II QA program of specific task QA/QC procedures, and auditing of specific tasks at established intervals. These QACs report to CDM's corporate QA director RAC II (QAM) and are independent of the SM's reporting structure.

The ASC, Mr. Scott Kirchner, will ensure that the subcontract analytical laboratory will perform analyses as described in the QAPP. The ASC provides assistance with meeting EPA sample management and paperwork requirements.

The task numbering system for the RI/FS effort is described in Section 5 of this work plan. Each of these tasks has been scheduled and will be tracked separately during the course of the RI/FS work. For the RAC II contract, the key elements of the monthly progress report will be submitted within 20 calendar days after the end of each reporting period and will consist of a summary of work completed during that period and associated costs.

Project progress meetings will be held, as needed, to evaluate project status, discuss current items of interest, and review major deliverables such as the work plan, QAPP, the data evaluation summary report, the RI report, the human health risk assessment, the SLERA report, and the FS report.

7.2 Quality Assurance and Document Control

All work by CDM on this work assignment will be performed in accordance with the CDM RAC II Quality Management Plan (QMP) (December 2005).

The RAC II RQAC will maintain QA oversight for the duration of the work assignment. A CDM QAC has reviewed this work plan for QA requirements. A QAPP governing field sampling and analysis is required and will be prepared in accordance with EPA R-5 and EPA Region II requirements. It will be submitted to an approved QAC for review and approval before submittal to EPA. Any reports for this work assignment which present measurement data generated during the work assignment will include a QA section addressing the quality of the data and its limitations. Such reports are subject to QA review following technical review. Statements of work for subcontractor services and subcontractor bids and proposals will receive technical and QA review.

The CDM SM is responsible for implementing appropriate QC measures on this work assignment. Such QC responsibilities include:

- Implementing the QC requirements referenced or defined in this work plan and in the QAPP
- Adhering to the CDM RAC Management Information System (RACMIS) document control system
- Organizing and maintaining work assignment files
- Conducting field planning meetings, as needed, in accordance with the RAC II QMP
- Completing measurement and test equipment forms that specify equipment requirements

Technical and QA review requirements as stated in the QMP will be followed on this work assignment.

Document control aspects of the program pertain to controlling and filing documents. CDM has developed a program filing system that conforms to EPA's requirements to ensure that the documents are properly stored and filed. This guideline will be implemented to control and file all documents associated with this work assignment. The system includes document receipt control procedures, a file review, an inspection system, and file security measures.

The RAC II QA program (QMP, Table 9-1) includes both self-assessments and independent assessments as checks on quality of data generated on this work assessment. Self assessments include management system audits, trend analyses, calculation checking, data validation, and technical reviews. Independent assessments include office, field and laboratory audits and the submittal of performance evaluation samples to laboratories.

One QA internal system audit and one field technical system audit are required. A laboratory technical system audit may be conducted by the CDM QA staff. Performance audits (i.e., performance evaluation samples) may be administered by CDM as required for any analytical parameters. An audit report will be prepared and distributed to the audited group, to CDM management, and to EPA. EPA may conduct or arrange a system or performance audit.

7.3 Project Coordination

The SM will coordinate all project activities with the EPA RPM. Regular telephone contact will be maintained to provide updates on project status. Field activities at the site will require coordination among federal, Commonwealth, and local agencies and coordination with involved private organizations. Coordination of activities with these stakeholders is described below.

EPA is responsible for overall direction and approval of all activities for the Cidra site. EPA may designate technical advisors and experts from academia or its technical support branches to assist on the site. Agency advisors could provide important sources of technical information and review, which the CDM team will use from initiation of RI/FS activities through final reporting.

Sources of technical information include EPA, Puerto Rico Environmental Quality Board (PREQB), PRASA, USGS, and sampling conducted during previous investigations. These sources can be used for background information on the site and surrounding areas.

The Commonwealth, through PREQB, may provide review, direction, and input during the RI/FS. EPA's RPM will coordinate contact with personnel from other agencies.

Local agencies that may be involved include PRASA, and local departments such as planning boards, zoning and building commissions, police, fire, health departments, and utilities (water and sewer). Contacts with these local agencies will be coordinated through EPA.

Private organizations requiring coordination during the RI/FS include residents in the area and public interest groups such as environmental organizations and the press. Coordination with these interested parties will be performed through EPA.

Section 8 References

Calabrese, E.J. and L. A. Baldwin. 1993. Performing Ecological Risk Assessments. Lewis Publishers, Chelsea, MI.

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Section 9
Glossary of Abbreviations

ARARs	Applicable or Relevant and Appropriate Requirements
ASC	Analytical Services Coordinator
bgs	below ground surface
BOA	Basic ordering agreement
CCC	Cidra Convention Center
CDM	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
CIP	Community Involvement Plan
cis-1,2-DCE	cis-1,2-dichloroethene
CLASS	Contract Laboratory Analytical Support Services
CLP	Contract Laboratory Program
CMC	Caribbean Manufacturing Co.
CO	Contracting Officer
COPC	Chemical of Potential Concern
COPEC	Contaminant of Potential Ecological Concern
CSM	conceptual site model
CTE	Central Tendency Exposure
DESA	Division of Environmental Science and Assessment
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DPT	Direct push technology
DQI	Data Quality Indicator
DQO	Data Quality Objective
Eh	Oxidation-Reduction Potential
EPA	United States Environmental Protection Agency
EPC	Exposure point concentration
EQuIS	Environmental Quality Information Systems
ERAGS	Ecological Risk Assessment Guidance for Superfund
ERTC	Environmental Response Team Contractor
ESI	Expanded Site Inspection
F	Fahrenheit
FASTAC	Field and Analytical Services Teaming Advisory Committee
FS	feasibility study
FTL	Field Team Leader
GIS	Geographic Information System
gpm	gallons per minute
GPS	Global Positioning System
HEAs	Health Effects Assessment
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Index

HQ	Hazard Quotient
HRS	Hazard Ranking System
HSP	Health and Safety Plan
IDW	Investigation Derived Waste
IFB	Invitation For Bid
INT	International Dry Cleaners
IRIS	Integrated Risk Information System
kg	kilogram
L	liter
LD_{50}	median lethal dose
LEL	Lowest effects level
LOAEL	Lowest observed adverse effect level
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg	milligram
mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
msl	Mean Sea Level
NCP	National Contingency Plan
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No observed adverse effect level
NPDES	National Pollution Discharge Elimination System
NPL	National Priority List
OSWER	Office of Solid Waste and Emergency Response
PAR	Pathway Analysis Report
PCB	Polychlorinated biphenyl
PCE	tetrachloroethylene
PH	Project hydrogeologist
PID	photoionization detector
PLOE	professional level of effort
PO	Project Officer
POTW	Publically Owned Treatment Works
ppb	parts per billion
PPRTV	Provisional Peer Reviewed Toxicity Values
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRB	permeable reactive barriers
PRDOH	Puerto Rico Department of Health
PREQB	Puerto Rico Environmental Quality Board
PRGs	Preliminary Remediation Goals
PRP	Potentially responsible party
QA/QC	quality assurance/quality control
QAC	Quality Assurance Coordinator
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
RA	risk assessment
RAC	Response Action Contract

RACMIS	RAC Management Information System
RAGS	Risk Assessment Guidance for Superfund
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RFP	request for proposal
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RME	reasonable maximum exposure
ROD	Record of Decision
RPM	Remedial Project Manager
RQAC	Regional Quality Assurance Coordinator
RSCC	Regional Sample Control Center
SARA	Superfund Amendments and Reauthorization Act of 1986
SAT	Site Assessment Team
SEL	severe effects limit
SLERA	Screening Level Ecological Risk Assessment
SM	site manager
SMO	Sample Management Office
SOP	Standard Operating Procedures
SOW	Statement of Work
SQL	Sample quantitation limit
SS	Senior Scientist
SSL	Soil Screening Level
STSC	Superfund Health Risk Technical Support Center
SVOC	semi-volatile organic compound
TA	Technical Advisor
TAL	Target Analyte List
TBC	"To Be Considered" Material
TCE	Trichloroethene
TCL	Target Compound List
TDS	Total dissolved solids
TGP	Tech Group Puerto Rico
the site	Cidra Groundwater Contamination Site
TKN	total Kjehldahl nitrogen
TOC	total organic carbon
TOM	Technical Operations Manager
trans-1,2-DCE	trans-1,2-dichloroethene
TRC	Technical Review Committee
TSS	total suspended solids
TSCA	Toxic Substances Control Act
UCL	Upper Confidence Limit
UFP	Uniform Federal Policy
μg/L	micrograms/liter
USC	United States Code
USGS	United States Geological Survey
VOC	volatile organic compound

WACR	Work Assignment Close-Out Report
WPC	Work Plan Coordinator
ZEN	Zenith Laboratories
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethylene
1,2-DCE	1,2-dichloroethylene
1122-TCA	1,1,2,2-trichloroethane

Table 2-1
VOC Sample Quantitation Limit Exceedances
EPA Groundwater Sampling Event, June 2002
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Compound	Units	EPA MCL	Cidra #3 6/17/2002	Cidra #6 6/14/2002	Cidra #6 Duplicate 6/14/2002	Cidra #4 6/14/2002
Trichlorofluoromethane	µg/L	NL	0.23 J	0.13 J	0.18 J	**0.60**
1,1-Dichloroethene	µg/L	7	0.29 J	0.50 U	0.50 U	0.50 U
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	NL	0.50 U	0.50 U	0.50 U	0.50 U
Methyl tert-butyl ether	µg/L	NL	0.24 J	0.18 J	0.17 J	0.38 J
1,1-Dichloroethane	µg/L	NL	0.50 U	0.50 U	0.50 U	0.50 U
cis-1,2-Dichloroethene	µg/L	70	**1.00**	0.50 U	0.50 U	0.50 U
Chloroform	µg/L	80	**6.00**	**6.30**	**6.10**	**6.50**
Carbon Tetrachloride	µg/L	5	**0.55**	0.16 J	0.17 J	0.41 J
Benzene	µg/L	5	0.50 U	0.50 U	0.50 U	0.50 U
Trichloroethene	µg/L	5	0.33 J	0.50 U	0.50 U	0.50 U
Bromodicloromethane	µg/L	80	**0.80**	**0.86**	**0.84**	**0.82**
cis-1,3-Dichloropropene	µg/L	NL	0.17 J	0.50 U	0.50 U	0.50 U
Toluene	µg/L	1000	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	µg/L	5	**10.00**	**0.64**	**0.72**	**0.74**
Ethylbenzene	µg/L	700	0.50 U	0.50 U	0.50 U	0.50 U
Xylene (Total)	µg/L	10000	0.50 U	0.50 U	0.50 U	0.50 U
Bromoform	µg/L	80	0.50 U	0.50 U	0.50 U	0.50 U

Bold - Exceeds Sample Quantitation Limit (SQL) of 0.5 µ/L
Shading - Exceeds EPA MCL
Abbreviations/ Notes:
µg/L= micrograms per Liter
NL= Chemical name not listed
MCL= Maximum Contaminant Level
J= Estimated data due to exceeded quality control criteria.
U= Compound was analyzed for but not detected. The associated numerical value is the sample quantitation limit.

Table 2-1
VOC Sample Quantitation Limit Exceedances
EPA Groundwater Sampling Event, June 2002
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Compound	Units	EPA MCL	GlaxoSmithKline #1 6/12/2002	GlaxoSmithKline #2 6/12/2002	IVAX #1 6/12/2002	IVAX #2 6/12/2002
Trichlorofluoromethane	µg/L	NL	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethene	µg/L	7	0.12 J	0.50 UJ	**8.40 J**	**7.60 J**
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	NL	0.50 U	0.50 U	0.50 U	0.50 U
Methyl tert-butyl ether	µg/L	NL	0.50 U	0.33 J	0.50 U	0.50 U
1,1-Dichloroethane	µg/L	NL	0.50 U	0.50 U	**0.51**	**0.62**
cis-1,2-Dichloroethene	µg/L	70	0.50 U	0.50 U	0.50 U	0.50 U
Chloroform	µg/L	80	0.50 U	**2.60**	**12.00**	**7.60**
Carbon Tetrachloride	µg/L	5	0.50 U	0.50 U	0.50 U	0.50 U
Benzene	µg/L	5	0.17 J	0.50 U	0.50 U	0.18 J
Trichloroethene	µg/L	5	0.50 U	0.50 U	0.50 U	0.50 U
Bromodiclorometha ne	µg/L	80	0.50 U	0.50 U	0.21 J	0.50 U
cis-1,3-Dichloropropene	µg/L	NL	0.50 U	0.50 U	0.50 U	0.50 U
Toluene	µg/L	1000	0.50 U	0.50 U	0.26 J	**1.20**
Tetrachloroethene	µg/L	5	0.46 J	**1.30**	**3.50**	**3.60**
Ethylbenzene	µg/L	700	0.50 U	0.50 U	0.50 U	0.10 J
Xylene (Total)	µg/L	10000	0.50 U	0.50 U	0.50 U	0.62
Bromoform	µg/L	80	0.50 U	0.50 U	0.21 J	0.22 J

Bold - Exceeds Sample Quantitation Limit (SQL) of 0.5 µ/L
Shading - Exceeds EPA MCL
Abbreviations/ Notes:
µg/L= micrograms per Liter
NL= Chemical name not listed
MCL= Maximum Contaminant Level
J= Estimated data due to exceeded quality control criteria.
U= Compound was analyzed for but not detected. The assoc

Table 2-1
VOC Sample Quantitation Limit Exceedances
EPA Groundwater Sampling Event, June 2002
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Compound	Units	EPA MCL	IVAX #2 Duplicate 6/12/2002	Cidra #8 6/14/2002	Millipore - Cidra 6/11/2002
Trichlorofluoromethane	µg/L	NL	0.50 U	0.50 U	**0.81**
1,1-Dichloroethene	µg/L	7	**12.00 J**	0.19 J	0.50 UJ
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	NL	0.50 U	0.50 U	**87.00 J**
Methyl tert-butyl ether	µg/L	NL	0.50 U	0.34 J	0.50 U
1,1-Dichloroethane	µg/L	NL	**0.70**	0.50 U	0.50 U
cis-1,2-Dichloroethene	µg/L	70	0.50 U	**0.95**	0.50 U
Chloroform	µg/L	80	**7.60**	**12.00**	0.50 U
Carbon Tetrachloride	µg/L	5	0.50 U	0.50 U	0.50 U
Benzene	µg/L	5	0.50 U	0.50 U	0.50 U
Trichloroethene	µg/L	5	0.50 U	0.27 J	0.15 J
Bromodicloromethane	µg/L	80	0.50 U	0.32 J	0.50 U
cis-1,3-Dichloropropene	µg/L	NL	0.14 J	0.50 U	0.50 U
Toluene	µg/L	1000	0.50 U	0.50 U	0.50 U
Tetrachloroethene	µg/L	5	**4.10**	**12.00**	**1.70**
Ethylbenzene	µg/L	700	0.50 U	0.50 U	0.50 U
Xylene (Total)	µg/L	10000	0.50 U	0.50 U	0.50 U
Bromoform	µg/L	80	0.25 J	0.50 U	0.50 U

Bold - Exceeds Sample Quantitation Limit (SQL) of 0.5 µ/L
Shading - Exceeds EPA MCL
Abbreviations/ Notes:
µg/L= micrograms per Liter
NL= Chemical name not listed
MCL= Maximum Contaminant Level
J= Estimated data due to exceeded quality control criteria.
U= Compound was analyzed for but not detected. The assoc

Table 3-1
Rationale for Potential Contaminant Facility Listings
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Potential Contaminant Source Facility	Location	Rationale for Listing Facility as Potential Contaminant Source for the Cidra Groundwater Contamination Site
1. International Dry Cleaners	Cidra Commercial Center	**Soil:** PCE at 11,000 µg/kg; TCE at 2,800 µg/kg; and cis-1,2-DCE at 5,100 µg/kg were detected in the 4-foot sample during ESI*. The same compounds were detected in the 7-foot sample at lower concentrations, while only cis-1,2-DCE at 6,700 µg/kg was detected in the 2-foot sample. The levels of PCE, TCE, and cis-1,2-DCE exceed EPA's generic migration-to-groundwater Soil Screening Levels (SSL).
2. Former Excellent Dry Cleaners	Cidra Commercial Center	Site is a potential contaminant source of VOCs due to past operations and was not investigated during the ESI*. Site was added to potential source investigation by EPA at Technical Scoping Meeting on December 13, 2005.
3. Unnamed Former Dry Cleaners	Cidra Commercial Center	Site is a potential contaminant source of VOCs due to past operations and was not investigated during the ESI*. Site was added to potential source investigation by EPA at Technical Scoping Meeting on December 13, 2005.
4. Cidra Convention Center	Cidra Industrial Park	Numerous environmental issues were associated with previous operators at the site; most notably an observation was reported in the ESI* of discolored wastewater flowing through drainage systems near the facility and into the street. **Soil:** PCE was detected in two soil samples at 5 µg/kg and 2 µg/kg during the ESI*.
5. CCL Label	Cidra Industrial Park	VOCs were not detected in soil samples during the ESI*. However based on the facility's history of possible usage of VOCs the facility remains a possible source.
6. IVAX/Zenith Laboratories	Cidra Industrial Park	**Groundwater:** 1,1-DCE was detected ranging from 7.6 µg/l to 12 µg/l and 1,1-DCA ranging from 0.51 µg/l to 0.70 µg/l in the site process wells during the ESI activities. **Soil:** 1,1-DCE was detected at 20 µg/kg (exceeding EPA's generic migration-to-groundwater SSL) in a soil sample collected at a 62 foot depth. No VOC concentrations were detected above background in any samples collected from the surficial or intermediate depths during the ESI*.
7. Pepsi Facility	Cidra Industrial Park	Site is a potential contaminant source of VOCs due to past operations and was not investigated during the ESI*. An uncovered dumping area was noticed on historical aerial photographs. Site was added to potential source investigation by EPA at Technical Scoping Meeting on December 13, 2005.
8. Esso Gas Station	Route 171	Site is a potential contaminant source of VOCs due to present and/or past operations and was not investigated during the ESI*. Site is located near closed public supply wells. Site was added to potential source investigation by EPA at Technical Scoping Meeting on December 13, 2005.
9. Machine Shop Adjacent to Esso	Route 171	Site is a potential contaminant source of VOCs due to present and/or past operations and was not investigated during the ESI*. Site is located near closed public supply wells. Site was added to potential source investigation by EPA at Technical Scoping Meeting on December 13, 2005.

Note: ESI* - EPA. 2003a. Expanded Site Inspection/Remedial Investigation Report (ESI), Cidra Groundwater Plume, Cidra, Puerto Rico: Region 2 Site Assessment Team (SAT), Weston Solutions, Inc, September 2003.

Abbreviations:
µg/kg= micrograms per kilogram
µg/L= micrograms per Liter
VOCs= Volatile Organic Compounds
1,1-DCE= 1,1-Dichloroethene
1,1-DCA= 1,1-Dichloroethane

Table 4-1
Summary of Data Quality Levels
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Data Uses	Analytical Level (1)	Types of Analysis
Site characterization monitoring during implementation	Screening level with definitive level confirmation	- Total organic vapor using instruments - Water quality field measurements using portable instruments
Risk assessment Site Characterization Monitoring during implementation	Definitive level	- Organics/Inorganics using EPA-approved methods - CLP SOWs - Standard water analyses - Analyses performed by laboratory
Site characterization	DQO level Field instrument (2)	- Measurements from field equipment - Qualitative measurements

(1) Definitions of analytical levels: Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Screening data provide analyte (or at least chemical class) identification and quantification, although the quantification may be relatively imprecise. For definitive confirmation, approximately 10 percent of the screening data are confirmed using analytical methods and quality control procedures and criteria associated with definitive data. Screening data without associated confirmation data are generally not considered to be data of known quality.

Definitive data are generated using rigorous analytical methods, such as EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods generating definitive data produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the quality control requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined.

(2) DQO = Measurement-specific Data Quality Objective requirements will be defined in the QAPP.

Table 5-1

Summary of Sampling and Analysis Program
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Sample Locations	Sample Matrix	Field Parameters	CLP Analytical Parameters	DESA or Subcontract Lab Analytical Parameters	Number of Samples (1)	Sample Frequency/Intervals
Existing Supply and Production Wells - Stage Ia						
Existing Supply and Production Wells	GW	DO, Eh, Turb, pH, Cond, Temp	LDL VOCs, TCL SVOCs and P/PCBs, TAL metals, cyanide	NA	23	3 per well from 4 inactive supply wells 11 production wells
Packer Test Samples						
Stage Ia Packer Test Samples	GW	DO, Eh, Turb, pH, Cond, Temp	NA	VOCs (24-hour turnaround)	33	5 boreholes 5 samples per borehole 1 borehole 8 samples per borehole
Stage Ib Packer Test Samples	GW	DO, Eh, Turb, pH, Cond, Temp	NA	VOCs (24-hour turnaround)	13	1 borehole 5 samples per borehole 1 borehole 8 samples per borehole
Stage II Packer Test Samples	GW	DO, Eh, Turb, pH, Cond, Temp	NA	VOCs (24-hour turnaround)	13	2 boreholes 4 samples per borehole 1 borehole 5 samples per borehole
Soil Samples						
Industrial Facilities Source Area Investigation	Soil	Screened for VOCs using a PID	Full TCL/TAL	pH, TOC, grain size (20 percent or 48 samples)	240	6 facilities 10 borings per facility 4 samples per boring *grain size will be collected at ½ of the locations

Table 5-1

Summary of Sampling and Analysis Program
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Sample Locations	Sample Matrix	Field Parameters	CLP Analytical Parameters	DESA or Subcontract Lab Analytical Parameters	Number of Samples (1)	Sample Frequency/Intervals
Current and Former Dry Cleaners Source Area Investigation	Soil	Screened for VOCs using a PID	Full TCL/TAL	pH, TOC, grain size (20 percent or 5 samples)	24	3 facilities 4 boring per facility 2 samples per boring (0-2 feet and 4-6 feet)
Multiport Monitoring Well Samples - Stage Ib and II						
Stage Ib - Round 1	GW	DO, Eh, Turb, pH, Cond, Temp, ferrous iron	LDL VOCs, TCL SVOCs and P/PCBs, TAL metals, cyanide	NA	42	1 sample per port 6 wells with 5 ports 2 wells with 6 ports
			NA	Chloride, methane, ethane, ethene, nitrate, nitrite, sulfate, sulfide, TOC, TDS, TSS, alkalinity, ammonia, hardness, and TKN	24	3 ports per well
Stage II - Round 2	GW	DO, Eh, Turb, pH, Cond, Temp, ferrous iron	LDL VOCs, TCL SVOCs and P/PCBs, TAL metals, cyanide	NA	54	1 sample per port 6 wells with 5 ports 2 wells with 6 ports 3 wells with 4 ports
			NA	Chloride, methane, ethane, ethene, nitrate, nitrite, sulfate, sulfide, TOC, TDS, TSS, alkalinity, ammonia, hardness, and TKN	33	3 ports per well

Table 5-1

Summary of Sampling and Analysis Program
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Sample Locations	Sample Matrix	Field Parameters	CLP Analytical Parameters	DESA or Subcontract Lab Analytical Parameters	Number of Samples (1)	Sample Frequency/Intervals
Stage II - Round 3	GW	DO, Eh, Turb, pH, Cond, Temp, ferrous iron	LDL VOCs, TCL SVOCs and P/PCBs, TAL metals, cyanide	NA	12	3 wells with 4 ports
			NA	Chloride, methane, ethane, ethene, nitrate, nitrite, sulfate, sulfide, TOC, TDS, TSS, alkalinity, ammonia, hardness, and TKN	3	3 ports per well
Surface Water and Sediment Samples - Stage II						
Surface Water	SW	DO, Eh, Turb,	LDL VOCs, TCL	Chloride, nitrate, nitrite, sulfate,	10	1 sample per location
Sediment	SD	NA	Full TCL/TAL	pH, TOC, grain size	10	1 sample per location

Notes: (1) environmental samples only

Abbreviations:
Cond = conductivity
DO = dissolved oxygen
Eh = oxidation-reduction potential
GW = groundwater
NA = not applicable
P/PCB = pesticides/polychlorinated biphenyl
SD = Sediment
SVOC = semivolatile organic compound
SW = surface water
TAL = Target Analyte List
TCL = Target Compound List
TDS = total dissolved solids
Temp = temperature
TKN = total Kjeldahl nitrogen
TOC = total organic carbon
TSS = total suspended solids
Turb = turbidity
VOC = volatile organic compound

Table 5-2
Industrial and Public Supply Wells Proposed for Sampling in Stage Ia
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Well Name	Active/ Inactive	Designated Use	Total Depth (feet)	Casing Depth (feet)	Open hole (feet)	Open Hole Diameter (inches)	No. of Samples	Analysis List			Sampling Method
								LDL VOCs	TCL SVOCs, Pesticides/ PCBs	TAL Metals	
Zenith 1	Active	Industrial	407	0-71	71-407	8	1	√	√	√	Directly from active well head
Zenith 2	Active	Industrial	367	0-72	72-367	8	1	√	√	√	Directly from active well head
Villa De Carmen	Active	Public Supply	unknown	unknown	unknown	unknown	1	√	√	√	Directly from active well head
Rabanal	Active	Public Supply	unknown	unknown	unknown	unknown	1	√	√	√	Directly from active well head
Pepsi	Active	Industrial	465	0-224	224-465	6	1	√	√	√	Directly from active well head
Mylan	Active	Industrial	357	0-180	185-357	8	1	√	√	√	Directly from active well head
Ciba-Vison I	Active	Industrial	305	0-68	68-305	7 7/8	1	√	√	√	Directly from active well head
Ciba-Vison II	Active	Industrial	500	0-60	60-500	6	1	√	√	√	Directly from active well head
Caribbean Refrescos	Active	Industrial	407	0-150	150-407	10	1	√	√	√	Directly from active well head
Zapera I	Inactive	Public Supply	unknown	unknown	unknown	unknown	1	√	√	√	Directly from active well head
Pelligrin Santos	Active	Public Supply (Community)	unknown	unknown	unknown	unknown	1	√	√	√	Directly from active well head
Cidra 3 1964	Inactive	Public Supply	110	0-42	unknown	unknown	3	√	√	√	Low Flow/Packer
Cidra 4	Inactive	Public Supply	unknown	unknown	unknown	unknown	3	√	√	√	Low Flow/Packer
Cidra 6 1967	Inactive	Public Supply	200	0-90	unknown	unknown	3	√	√	√	Low Flow/Packer
Cidra 8	Inactive	Public Supply	unknown	unknown	unknown	unknown	3	√	√	√	Low Flow/Packer

Abbreviations:
LDL VOCs - Low detection limit volatile organic compounds
TCL SVOCs - Target compound list semivoaltile orgnaic compounds
PCBs - Polychlorinated biphenyls
TAL - Target analyte list

Table 5-3
Proposed Drilling Methods, Aquifer Testing, and Rationale for Stage Ia Boreholes
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Borehole/ Monitoring Well ID	Proposed Borehole Drilling Method	Aquifer Testing	Rationale for Proposed Well Location
Stage IA			
MPW-01	Air Rotary	YES	Presumed downgradient (based on topography) of former dry cleaner. Near northwestern edge of plume based on affected public supply wells.
MPW-02	Coring	NO	Near international dry cleaners and presumed downgradient (based on topography) of former dry cleaner. Monitors northeastern edge of plume based on locations of affected public supply wells. Coring will provide lithology near northern boundary of affected public supply wells and Stage 1A wells.
MPW-03	Coring	NO	Located in center of plume based on locations of affected public supply wells. In an areas that receives the bulk of runoff from the topographically higher areas of Cidra. Runoff from former and current dry cleaners would be expected to discharge to this area. Coring will provide lithology for central portion of plume area.
MPW-04	Air Rotary	NO	Presumed downgradient of affected public supply wells (based on topography). Provide data for area south of the plume area (based on affected supply wells). Monitor southern extent of contamination.
MPW-05	Air Rotary	YES	Located between affected public supply well and IVAX/Zenith facility. Located near southeastern boundary of plume based on affected public supply wells. Location is also south of major drainage from town area and potential dry cleaner source.
MPW-06	Coring	YES	Monitor potential source area near Zenith/IVAX to evaluate potential migration of plume between MPW-05 and Zenith/IVAX Facility. Coring will provide lithology for southeastern boundary of plume area.

Notes:
MPW = Borehole/Multiport Well Location

Table 5-4
Proposed RI Report Format
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

1.0 Introduction
- 1.1 Purpose of Report
- 1.2 Site Background
  - 1.2.1 Site Description
  - 1.2.2 Site History
  - 1.2.3 Previous Investigations
- 1.3 Report Organization

2.0 Study Area Investigation
- 2.1 Surface Features (topographic mapping, etc.) (natural and manmade features)
- 2.2 Contaminant Source Investigations
- 2.3 Meteorological Investigations
- 2.4 Geological Investigations
- 2.5 Groundwater Investigation
- 2.6 Human Population Surveys
- 2.7 Ecological Investigation

3.0 Physical Characteristics of Site
- 3.1 Topography
- 3.2 Meteorology
- 3.3 Geology
- 3.5 Hydrogeology
- 3.6 Air Quality
- 3.7 Demographics and Land Use

4.0 Nature and Extent of Contamination
- 4.1 Sources of Contamination
- 4.2 Groundwater
- 4.3 Soil
- 4.4 Surface Water/Sediment

5.0 Contaminant Fate and Transport
- 5.1 Routes of Migration
- 5.2 Contaminant Persistence
- 5.3 Contaminant Migration

Table 5-4
Proposed RI Report Format
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

6.0 Baseline Risk Assessment
- 6.1 Human Health Evaluation
  - 6.1.1 Summary of Data Collection and Evaluation
  - 6.1.2 Exposure Assessment
  - 6.1.3 Toxicity Assessment
  - 6.1.4 Risk Characterization
  - 6.1.5 Uncertainty Assessment
- 6.2 Ecological Evaluation
  - 6.2.1 Screening Level Ecological Risk Assessment
  - 6.2.2 Ecological Risk Assessment

7.0 Summary and Conclusions
- 7.1 Source(s) of Contamination
- 7.2 Nature and Extent of Contamination
- 7.3 Fate and Transport
- 7.4 Risk Assessments
- 7.5 Data Limitations and Recommendations for Future Work
- 7.6 Recommended Remedial Action Objectives

Appendices
Analytical Data/QA/QC Evaluation Results
Boring Logs
Data

Table 5-5
Detailed Evaluation Criteria for Remedial Alternatives
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

- SHORT-TERM EFFECTIVENESS
  - Protection of community during remedial action
  - Protection of workers during remedial actions
  - Time until remedial response objectives are achieved
  - Environmental impacts

- LONG-TERM EFFECTIVENESS
  - Magnitude of risk remaining at the site after the response objectives have been met
  - Adequacy of controls
  - Reliability of controls

- REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT
  - Treatment process and remedy
  - Amount of hazardous material destroyed or treated
  - Reduction in toxicity, mobility or volume of the contaminants
  - Irreversibility of the treatment
  - Type and quantity of treatment residuals

- IMPLEMENTABILITY
  - Ability to construct technology
  - Reliability of technology
  - Ease of undertaking additional remedial action, if necessary
  - Monitoring considerations
  - Coordination with other agencies
  - Availability of treatment, storage capacity, and disposal services
  - Availability of necessary equipment and specialists
  - Availability of prospective technologies

- COST
  - Capital costs
  - Annual operating and maintenance costs
  - Present worth
  - Sensitivity Analysis

Table 5-5
Detailed Evaluation Criteria for Remedial Alternatives
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

- COMPLIANCE WITH ARARs
  - Compliance with chemical-specific ARARs
  - Compliance with action-specific ARARs
  - Compliance with location-specific ARARs
  - Compliance with appropriate criteria, advisories and guidance
- OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT
- STATE ACCEPTANCE
- COMMUNITY ACCEPTANCE

Table 5-6
Proposed FS Report Format
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

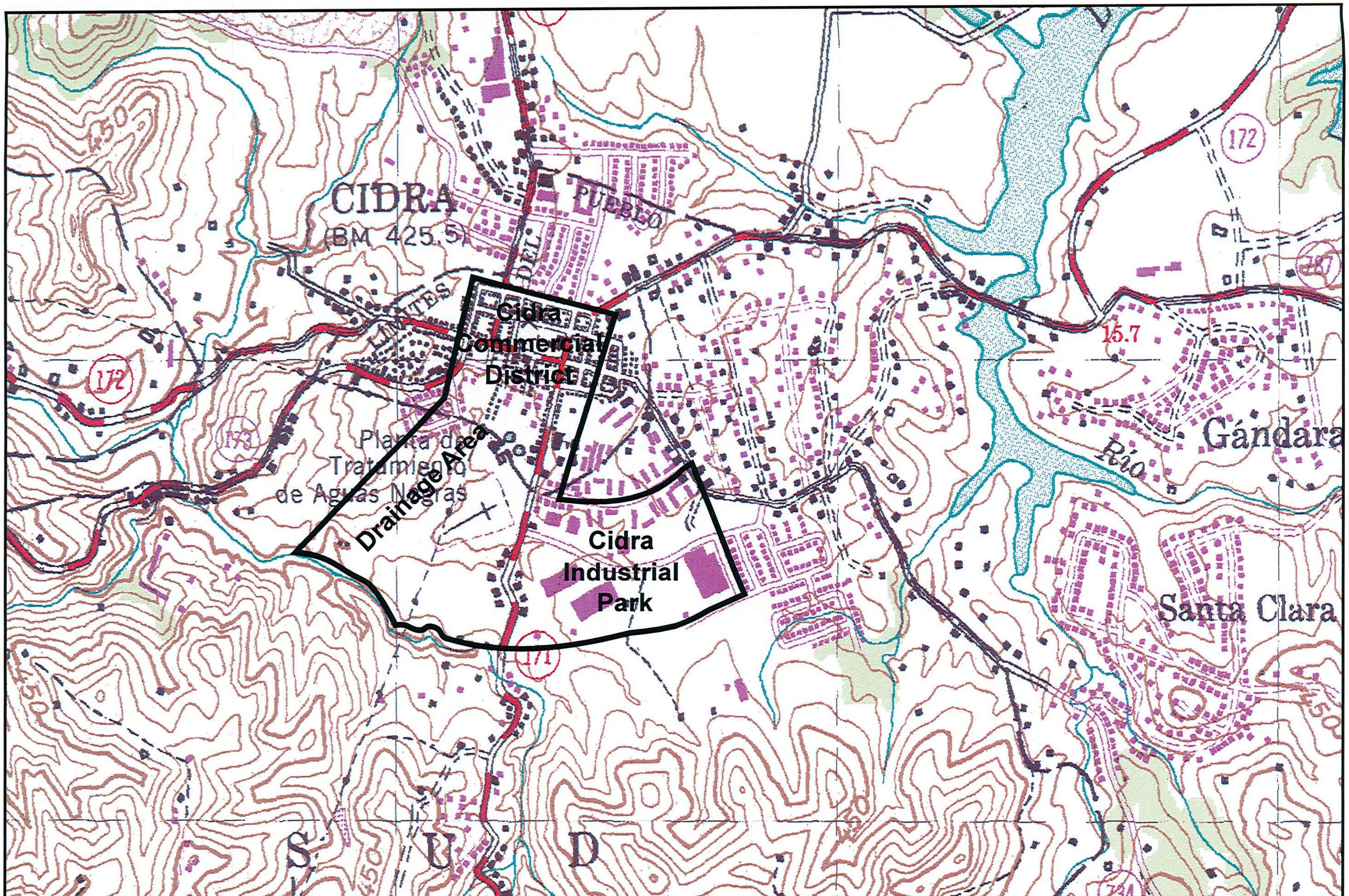
1.0 Introduction and Summary of Remedial Investigation
- 1.1 Purpose and Organization of Report
- 1.2 Site Description and History
- 1.3 Site
- 1.4 Source(s) of Contamination
- 1.5 Nature and Extent of Contamination
- 1.6 Contaminant Fate and Transport
- 1.7 Risk Assessment Summaries

2.0 Identification and Screening of Remedial Technologies
- 2.1 Remedial Action Objectives
  - Contaminants of Interest
  - Allowable Exposure Based on Risk Assessment
  - Allowable Exposure Based on ARARs
  - Development of Remedial Action Objectives
- 2.2 General Response Actions
  - Volumes
  - Containment
  - Technologies
- 2.3 Screening of Technology and Process Options
  - 2.3.1 Description of Technologies
  - 2.3.2 Evaluation of Technologies
  - 2.3.3 Screening of Alternatives
  - Effectiveness
  - Implementability
  - Cost

3.0 Development and Initial Screening of Alternatives
- 3.1 Development of Alternatives
- 3.2 Screening of Alternatives
  - 3.2.1 Alternative 1
  - 3.2.2 Alternative 2
  - 3.2.3 Alternative 3

4.0 Description and Detailed Analysis of Alternatives
- 4.1 Description of Evaluation Criteria
  - Short-Term Effectiveness
  - Long-Term Effectiveness and Permanence
  - Implementability
  - Reduction of Mobility, Toxicity, or Volume Through Treatment
  - Compliance with ARARs
  - Overall Protection
  - Cost
  - State Acceptance

Table 5-6
Proposed FS Report Format
Cidra Groundwater Contamination Site
Cidra, Puerto Rico



Source USGS 7.5 Minute Series Topographic Map, Comerio Quadrangle, Puerto Rico

Site Area

N

approximate scale

0 0.25 0.5 miles

Figure 1-1
Site Location Map
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibility Study
Cidra, Puerto Rico

CDM

R2-0004966

Active Public Supply Wells
Closed Public Supply Wells
Potential Source Facilities
Industrial Supply Wells

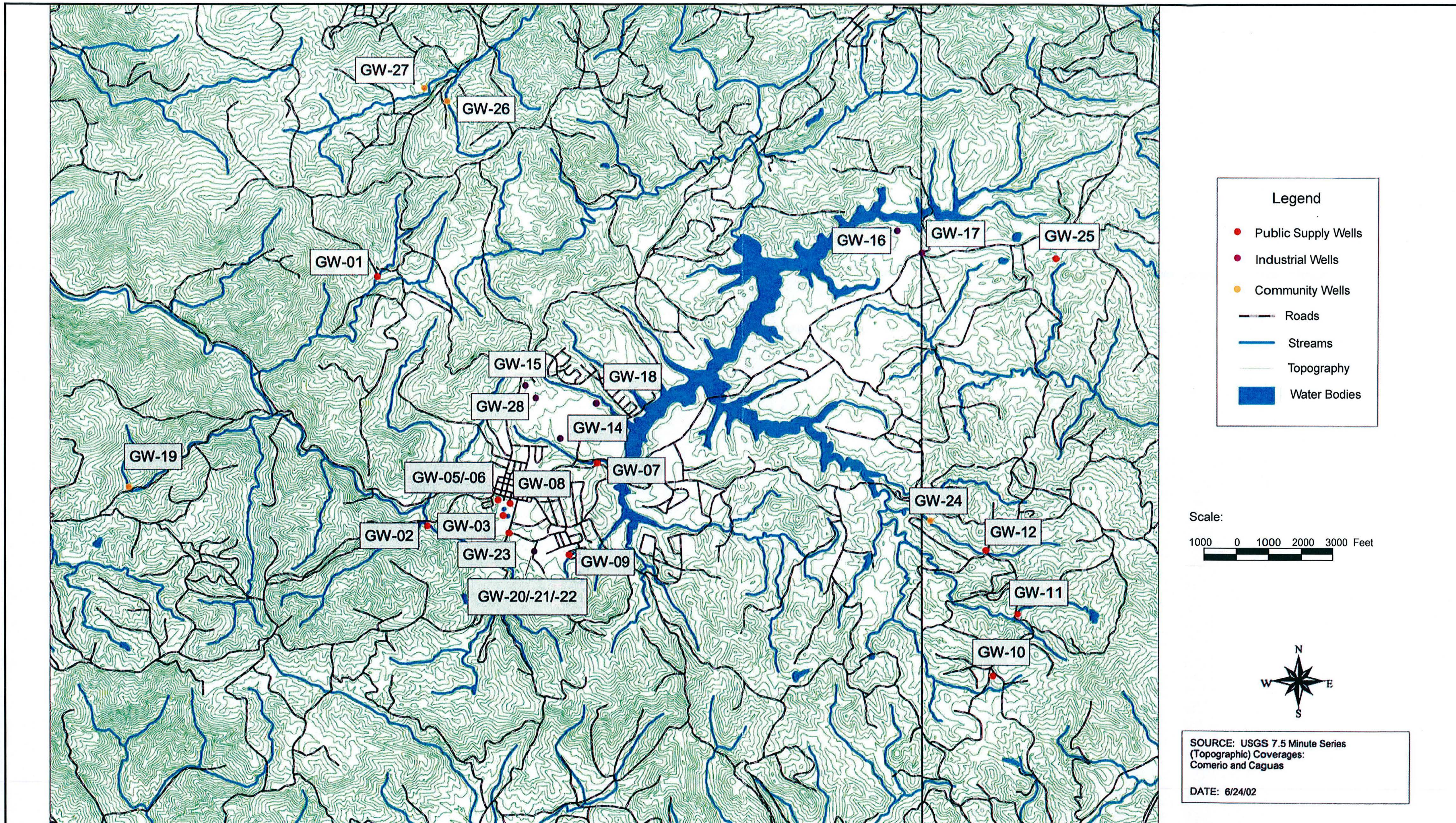
N

approximate scale

0 — 0.25 Miles

Figure 1-2
Site Map
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibiity Study
Cidra, Puerto Rico

CDM



Source: EPA Region 2 SAT Expanded Site Inspection Report (EPA 2003a)

Figure 2-1
Expanded Site Inspection Supply Well Groundwater Sampling Locations, June 2002
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibility Study
Cidra, Puerto Rico

CDM

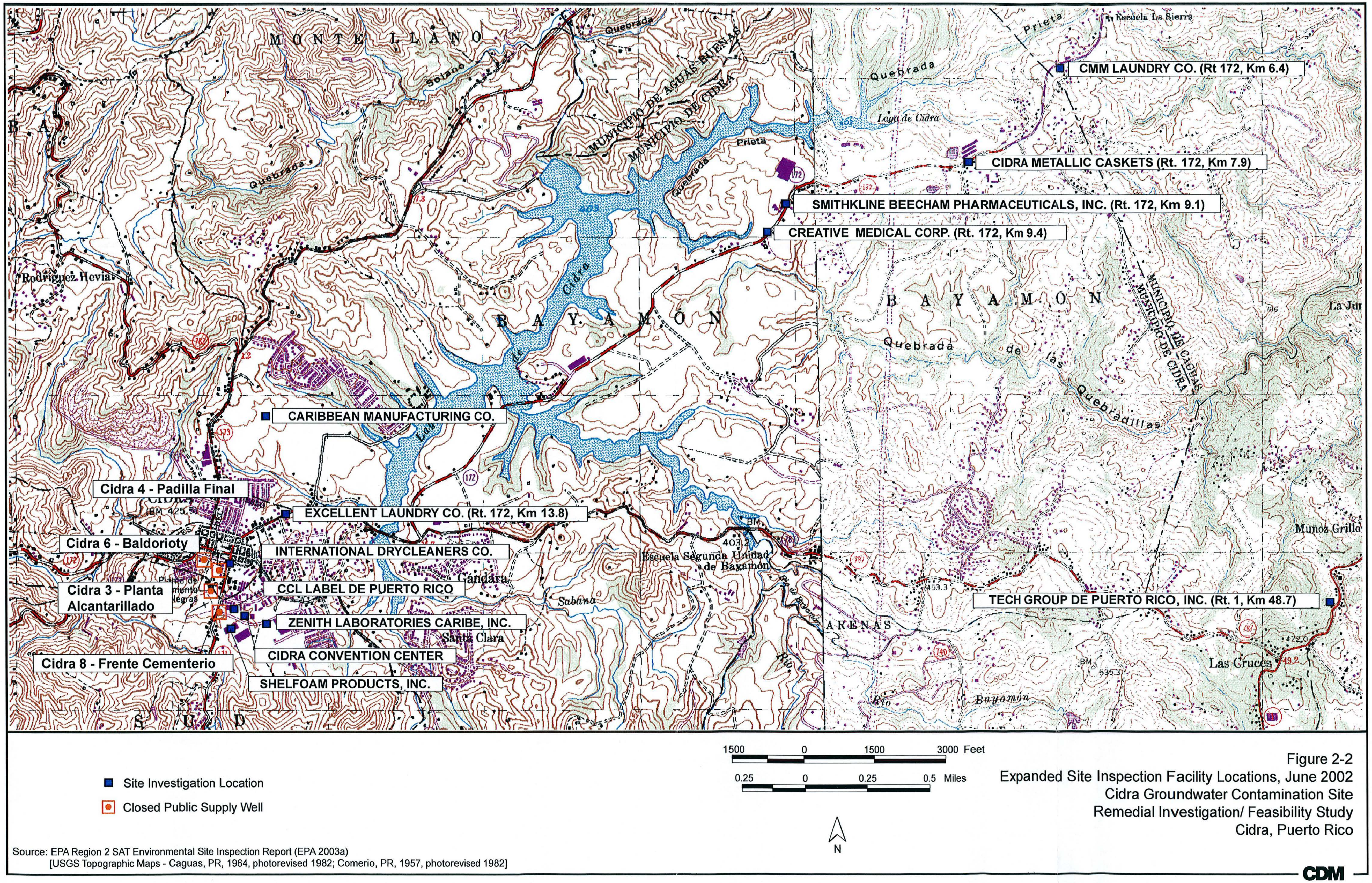
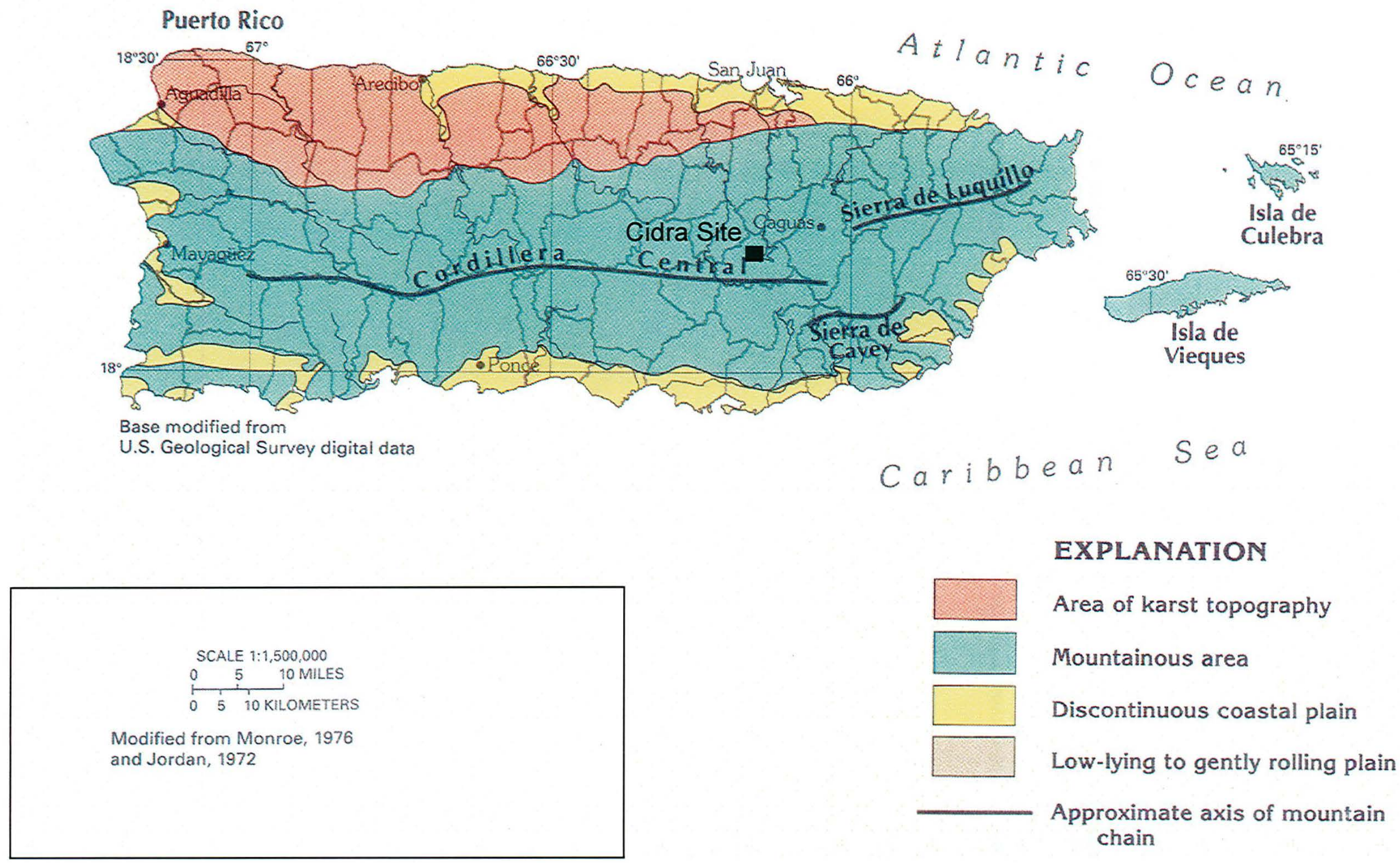


Figure 2-2
Expanded Site Inspection Facility Locations, June 2002
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibility Study
Cidra, Puerto Rico

Source: EPA Region 2 SAT Environmental Site Inspection Report (EPA 2003a)
[USGS Topographic Maps - Caguas, PR, 1964, photorevised 1982; Comerio, PR, 1957, photorevised 1982]

CDM



Adapted from Miller et al., (1997)

Figure 3-1
Topographic Featues of Puerto Rico
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibility Study
Cidra, Puerto Rico

CDM

R2-0004970

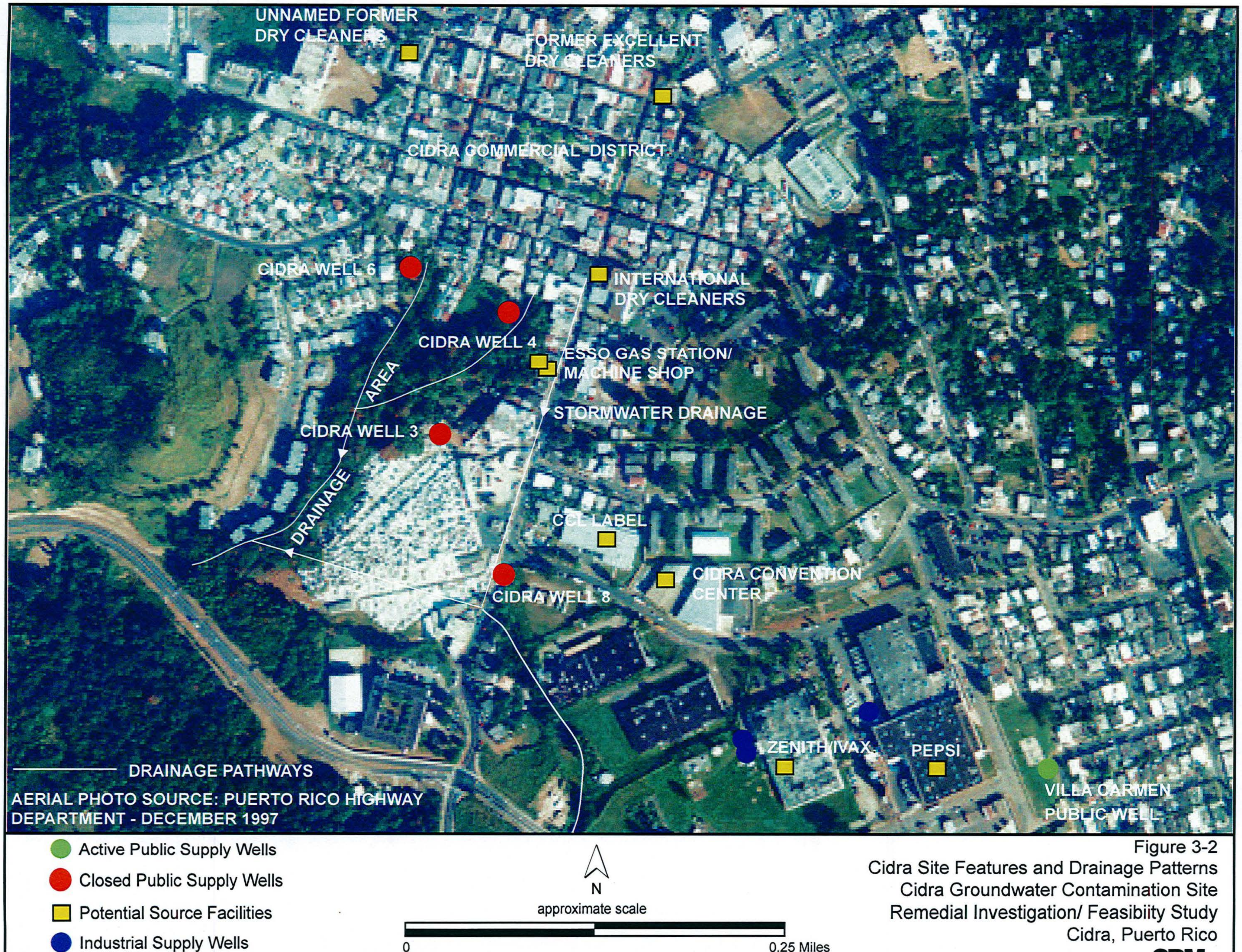
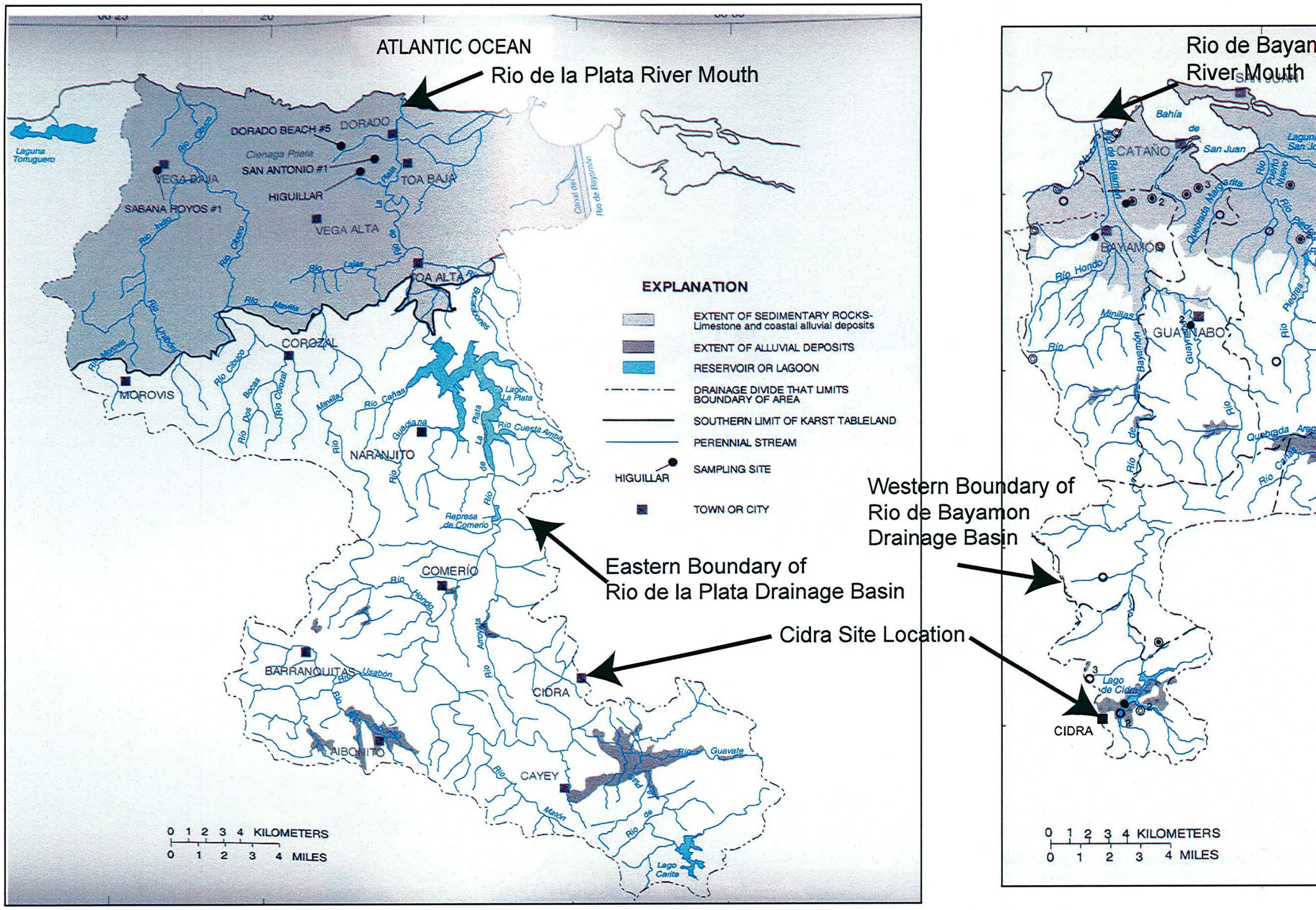


Figure 3-2
Cidra Site Features and Drainage Patterns
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibiity Study
Cidra, Puerto Rico

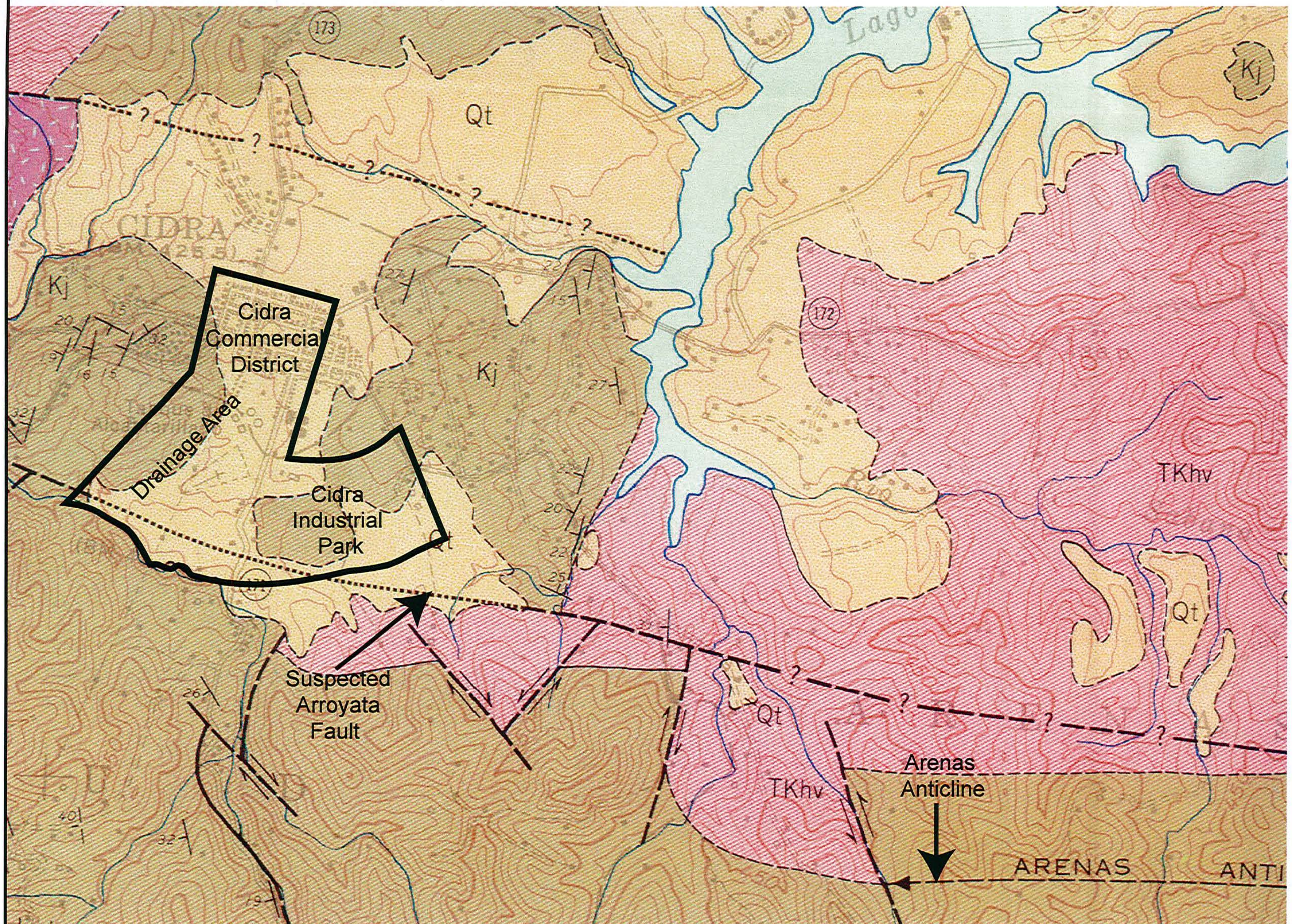


Adapted from Veve and Taggart (1996)

N

Figure 3-3
Cidra Site Location in Relation to Major Surface Water Drainages
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibility Study
Cidra, Puerto Rico

CDM



LEGEND

Qt — Terrace Deposits: Unconsolidated sand, gravel, and silt including large cobbles and boulders of volcanic rock; restricted to deposits generally above the level of present stream action

Kjl, Kjf, Kj — Formation J: Principally massive volcanic breccia and lava flows. Contains layers of poorly stratified tuff and volcanic conglomerate; fine-grained bedded rock occurs locally; a thin limestone lense, Kjl, and a lava flow, Kjf, delineated on the geologic map.

TKhv — Hydrothermally altered rocks: Light-gray clayey rock, mottled when weathered by shades of red, brown, and grayish purple; locally highly siliceous and well-indurated; banded in part at Cerro La Tiza

Note: Adapted from Pease and Briggs (1960)

Site

N

approximate scale

0 0.25 0.5 miles

Figure 3-4
Geologic Map of Site Vicinity
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibility Study
Cidra, Puerto Rico

CDM

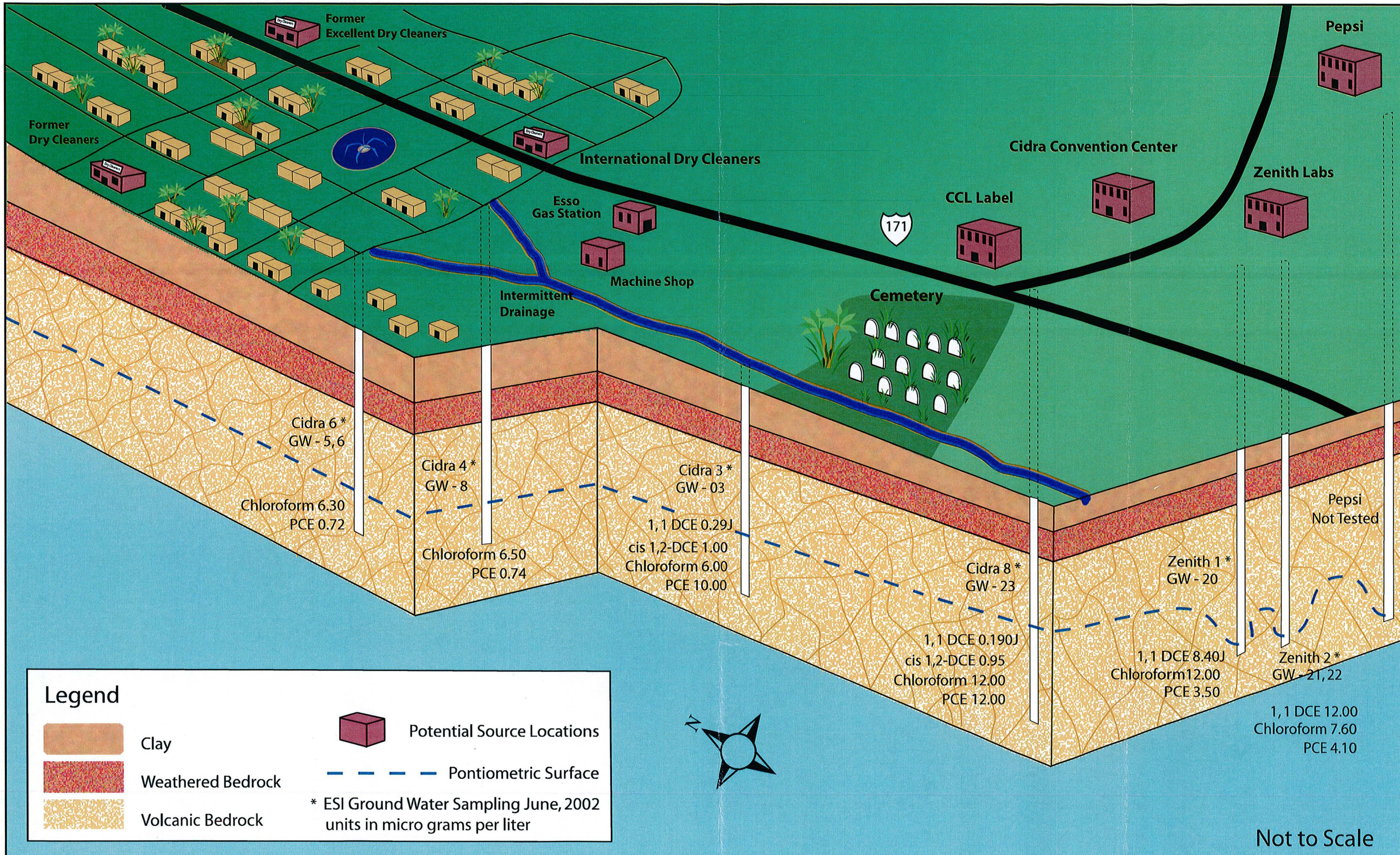


Figure 3-5
Site Conceptual Model
Cidra Groundwater Contamination Site
Remedial Investigation/Fesibility Study
Cidra, Puerto Rico
CDM

R2-0004974

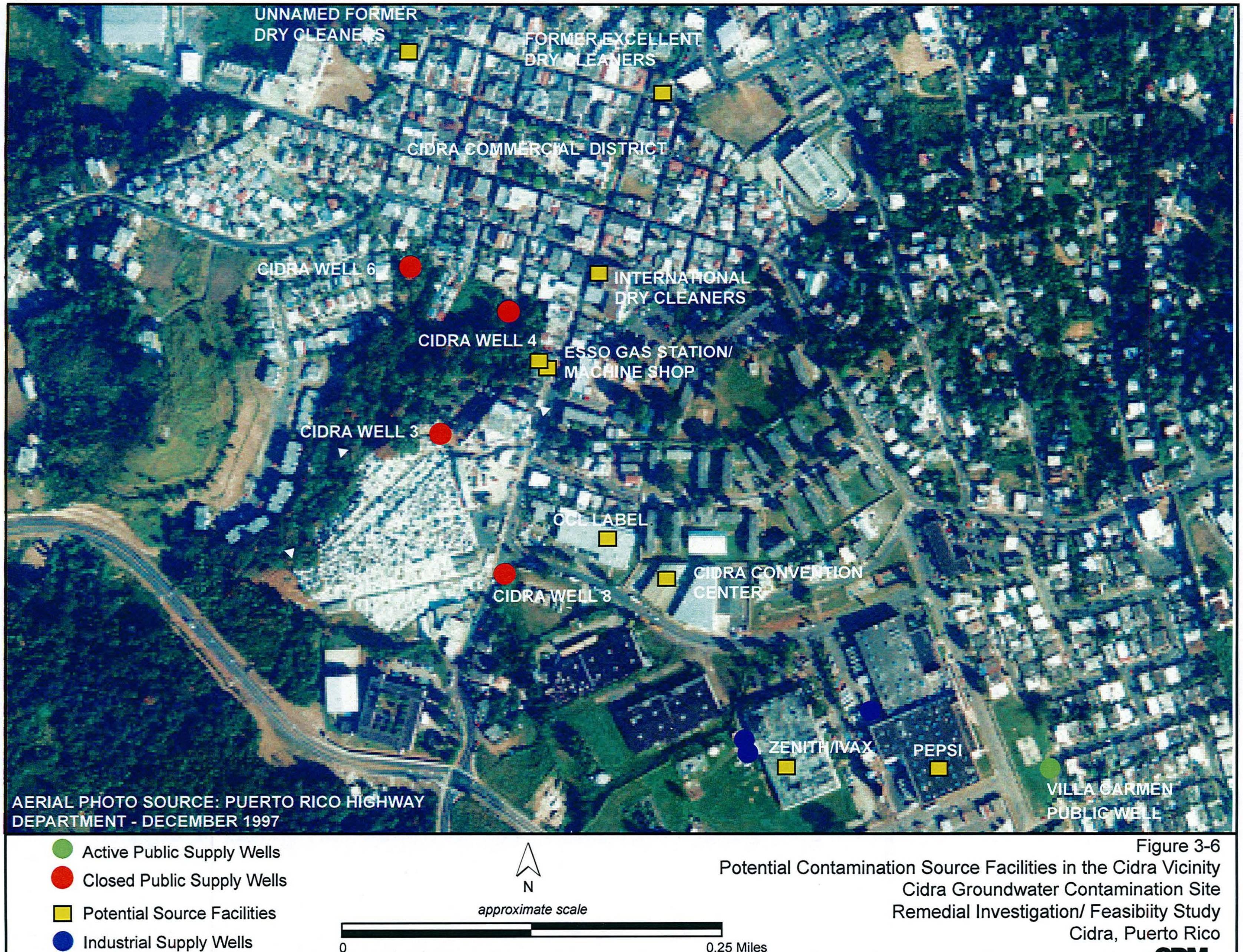
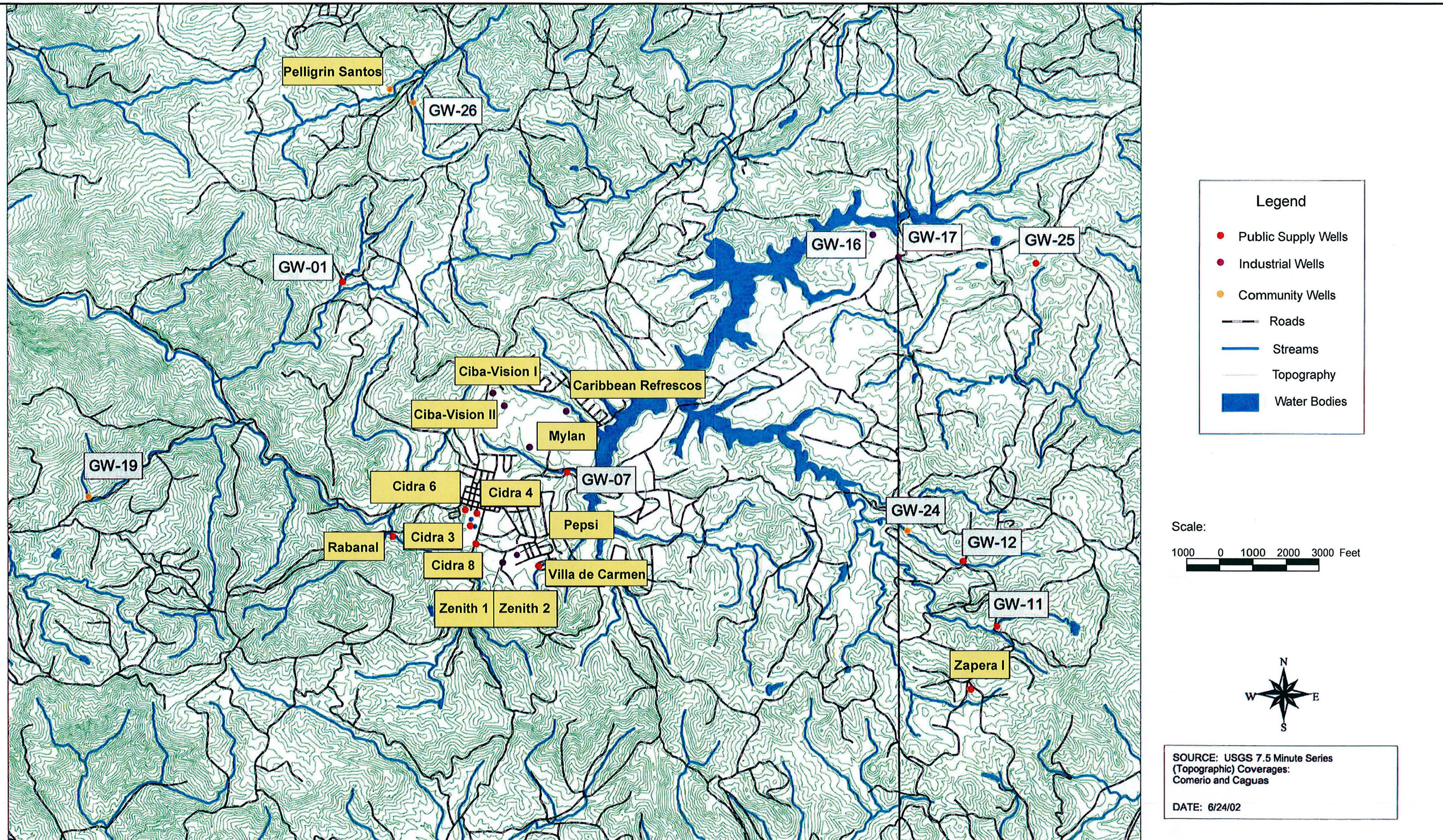


Figure 3-6
Potential Contamination Source Facilities in the Cidra Vicinity
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibity Study
Cidra, Puerto Rico

CDM

R2-0004975



Source: EPA Region 2 SAT Expanded Site Inspection Report (EPA 2003a)

Cidra 3 Supply Well Groundwater Sampling Locations

GW-03 Locations of Additional Supply Wells Sampled in June 2002

Figure 5-1
Supply Groundwater Sampling Locations
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibility Study
Cidra, Puerto Rico

CDM

Proposed Boreholes/ Monitoring Wells MPW-#
Current Dry Cleaner
Former Dry Cleaner
Closed Public Supply Wells

N

approximate scale

0 0.25 Miles

Figure 5-2
Location of Proposed Boreholes/ Monitoring Wells
Cidra Groundwater COntamination Site
Remedial Investigation/ Feasibiity Study
Cidra, Puerto Rico

CDM

R2-0004977

Hand Auger Soil Sampling Facility

DPT Soil Sampling Facility

N

approximate scale

0 0.25 Miles

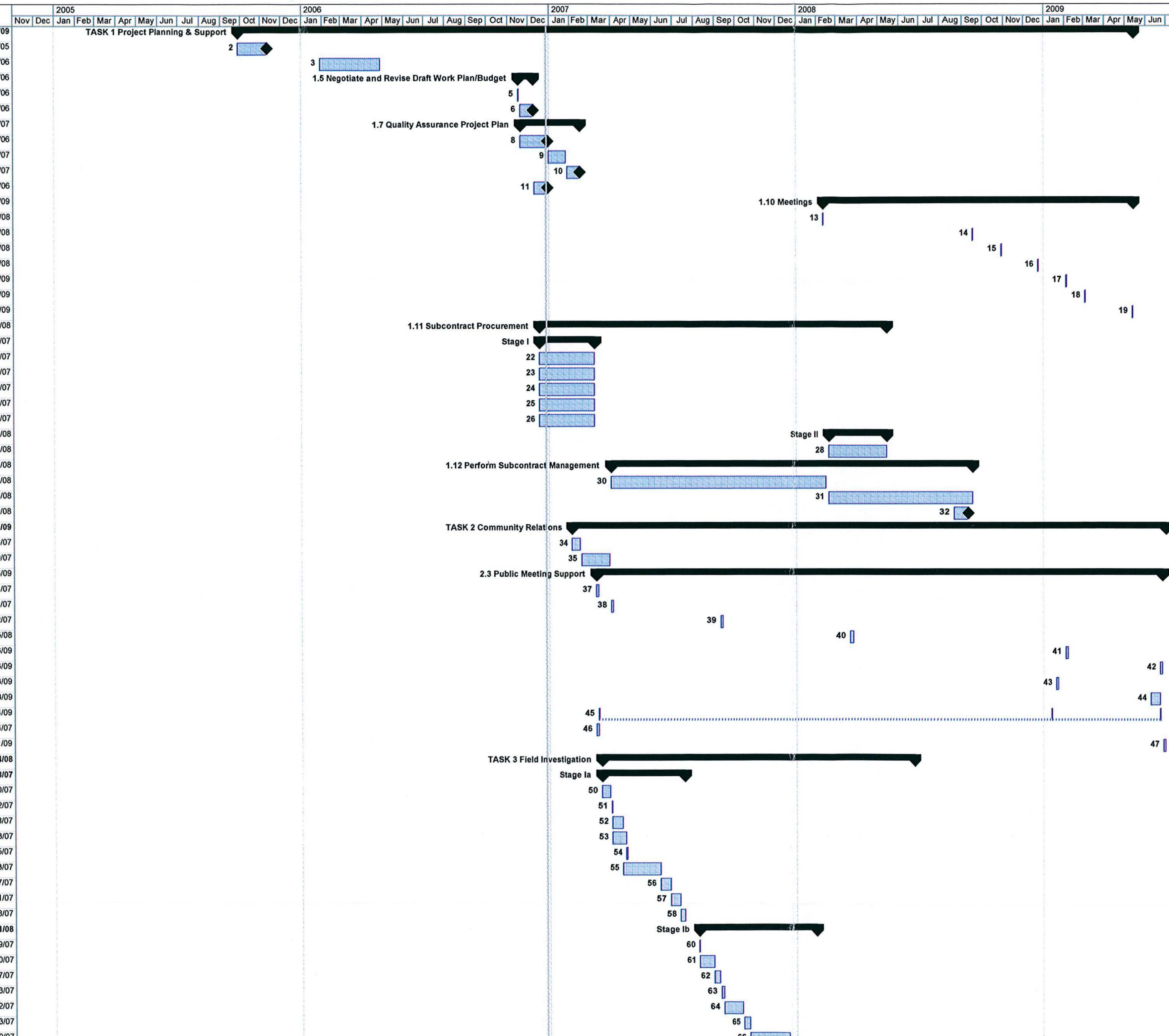
Figure 5-3
Hand Auger and DPT Soil Boring Investigation Facilities
Cidra Groundwater Contamination Site
Remedial Investigation/ Feasibiity Study
Cidra, Puerto Rico

CDM

R2-0004978

Figure 6-1
Cidra Groundwater Contamination Site
Project Schedule

ID		Task Name	Subtask	Start	Finish
1		**TASK 1 Project Planning & Support**		**Wed 9/28/05**	**Wed 5/13/09**
2		1.4 Develop Draft Work Plan and Associated Cost Estimate	1.4	Wed 9/28/05	Fri 11/11/05
3		EPA Review of Draft Work Plan		Mon 1/30/06	Thu 4/27/06
4		1.5 Negotiate and Revise Draft Work Plan/Budget	1.5	Fri 11/17/06	Fri 12/8/06
5		Negotiate Budget		Fri 11/17/06	Fri 11/17/06
6		Prepare/Submit Final Work Plan		Mon 11/20/06	Fri 12/8/06
7		1.7 Quality Assurance Project Plan	1.7	Mon 11/20/06	Fri 2/16/07
8		Prepare/Submit Draft QAPP		Mon 11/20/06	Fri 12/29/06
9		EPA Review		Mon 1/1/07	Fri 1/26/07
10		Prepare/Submit Final QAPP		Mon 1/29/07	Fri 2/16/07
11		1.8 Health & Safety Plan	1.8	Mon 12/11/06	Fri 12/29/06
12		1.10 Meetings	1.10	Tue 2/12/08	Wed 5/13/09
13		First Meeting - Stage 1b Technical Presentation		Tue 2/12/08	Tue 2/12/08
14		Second Meeting - Stage II Technical Presentation		Wed 9/17/08	Wed 9/17/08
15		Third Meeting - RA		Wed 10/29/08	Wed 10/29/08
16		Fourth Meeting - Draft RI		Wed 12/24/08	Wed 12/24/08
17		Fifth Meeting - FS Tech memo 1		Wed 2/4/09	Wed 2/4/09
18		Sixth Meeting - FS Tech Memo 2		Wed 3/4/09	Wed 3/4/09
19		Seventh Meeting - Draft FS		Wed 5/13/09	Wed 5/13/09
20		1.11 Subcontract Procurement	1.11	Mon 12/18/06	Tue 5/13/08
21		Stage I		Mon 12/18/06	Fri 3/9/07
22		Topographic Survey		Mon 12/18/06	Fri 3/9/07
23		Geophysical Services (downhole logging/packer test)		Mon 12/18/06	Fri 3/9/07
24		Drilling Services		Mon 12/18/06	Fri 3/9/07
25		Analytical Laboratory		Mon 12/18/06	Fri 3/9/07
26		Waste Hauling and Disposal		Mon 12/18/06	Fri 3/9/07
27		Stage II		Wed 2/20/08	Tue 5/13/08
28		Cultural Resources		Wed 2/20/08	Tue 5/13/08
29		1.12 Perform Subcontract Management	1.12	Mon 4/2/07	Tue 9/16/08
30		Stage I		Mon 4/2/07	Fri 2/15/08
31		Stage II		Wed 2/20/08	Tue 9/16/08
32		1.13 Pathway Anaysis Report (PAR)	1.13	Wed 8/20/08	Tue 9/9/08
33		**TASK 2 Community Relations**		**Mon 2/5/07**	**Wed 7/1/09**
34		2.1 Community Interviews	2.1	Mon 2/5/07	Fri 2/16/07
35		2.2 Community Relations Plan	2.2	Mon 2/19/07	Fri 3/30/07
36		2.3 Public Meeting Support	2.3	Mon 3/12/07	Fri 6/26/09
37		Public Meetings 1 - beginning of field work (includes preparation)		Mon 3/12/07	Wed 3/14/07
38		Public Availability Session 1 - Stage Ia (includes preparation)		Mon 4/2/07	Wed 4/4/07
39		Public Availability Session 2 - Stage Ib (includes preparation)		Mon 9/10/07	Wed 9/12/07
40		Public Availability Session 3 - Stage II (includes preparation)		Fri 3/21/08	Tue 3/25/08
41		Public Meetings 2 - Final RI (includes preparation)		Wed 2/4/09	Fri 2/6/09
42		Public Meetings 3 - Final proposed plan (includes preparation)		Wed 6/24/09	Fri 6/26/09
43		2.4 Fact Sheet Preparation	2.4	Wed 1/21/09	Fri 1/23/09
44		2.5 Proposed Plan Support	2.5	Wed 6/10/09	Tue 6/23/09
45		2.6 Public Notices	2.6	Thu 3/15/07	Wed 6/24/09
46		2.8 Site Mailing List	2.8	Mon 3/12/07	Wed 3/14/07
47		2.9 Responsiveness Summary Support	2.9	Mon 6/29/09	Wed 7/1/09
48		**TASK 3 Field Investigation**		**Mon 3/19/07**	**Tue 6/24/08**
49		**Stage Ia**		**Mon 3/19/07**	**Wed 7/18/07**
50		Mobilization	3.2	Mon 3/19/07	Fri 3/30/07
51		Site Reconnaissance - Locate Monitoring Wells/Soil Borings	3.1	Mon 4/2/07	Mon 4/2/07
52		Existing Supply/Production Well Evaluation and Sampling	3.3	Tue 4/3/07	Wed 4/18/07
53		Industrial Facilities Source Area Investigation - Soil Sampling	3.4	Tue 4/3/07	Mon 4/23/07
54		Current and Former Dry Cleaners Source Area Investigation - Soil Sampling	3.4	Tue 4/24/07	Wed 4/25/07
55		Borehole Drilling and Coring	3.3	Thu 4/19/07	Wed 6/13/07
56		Borehole Logging	3.3	Thu 6/14/07	Wed 6/27/07
57		Packer Sampling	3.3	Thu 6/28/07	Wed 7/11/07
58		Packer Test	3.3	Thu 7/12/07	Wed 7/18/07
59		**Stage Ib**		**Thu 8/9/07**	**Thu 1/31/08**
60		Mobilization	3.2	Thu 8/9/07	Thu 8/9/07
61		Borehole Drilling and Coring	3.3	Fri 8/10/07	Thu 8/30/07
62		Borehole Logging	3.3	Fri 8/31/07	Fri 9/7/07
63		Packer Sampling	3.3	Mon 9/10/07	Thu 9/13/07
64		Multiport Monitoring Well Installation and Development	3.3	Fri 9/14/07	Fri 10/12/07
65		Multiport Monitoring Well Sampling - Round 1	3.5	Mon 10/15/07	Tue 10/23/07
66		Long-Term Water Level Monitoring	3.3	Wed 10/24/07	Thu 12/20/07

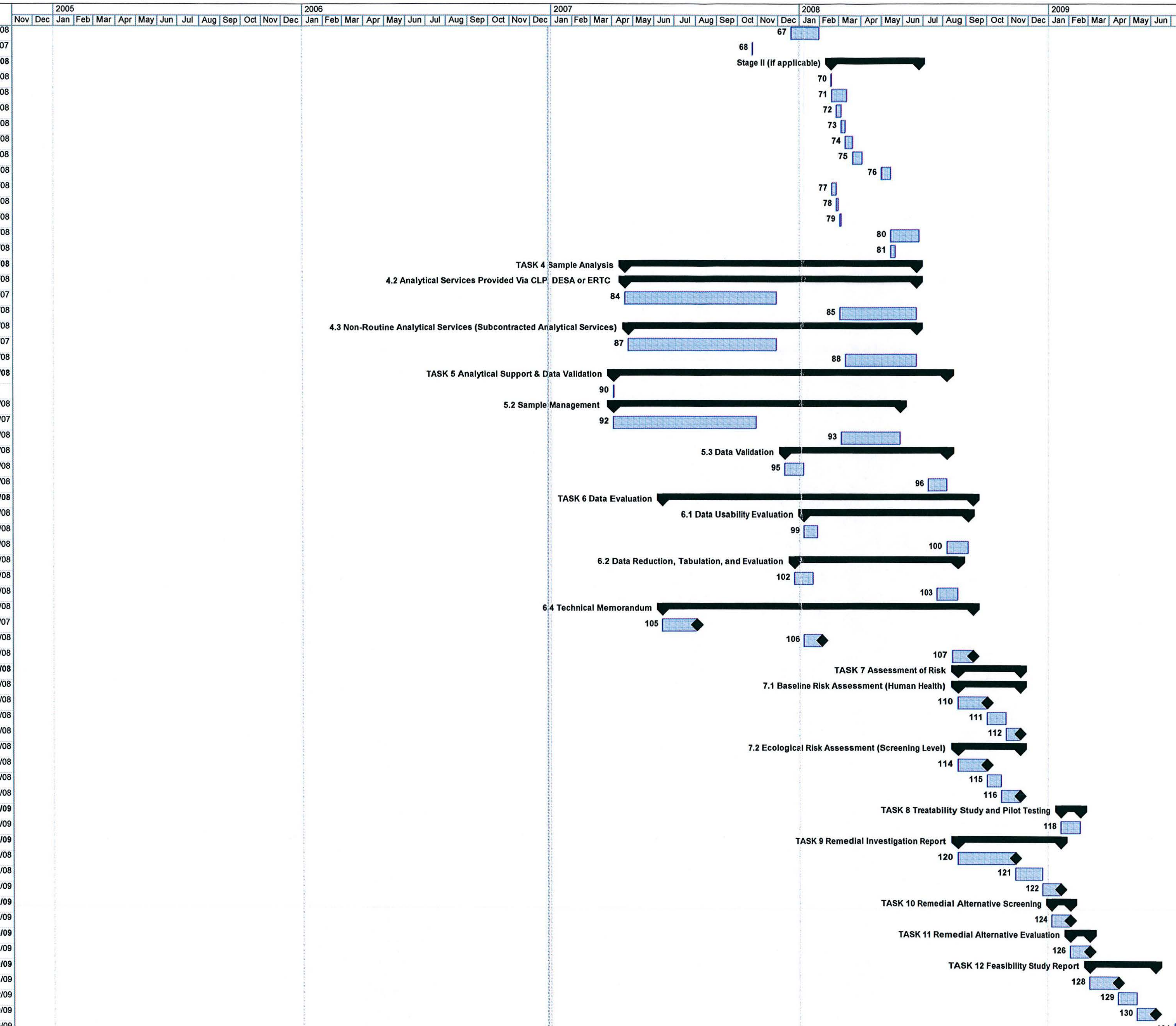


Project: 168Figschedule
Date: Wed 12/27/06

Task | Split | Progress | Milestone | Summary

Figure 6-1
Cidra Groundwater Contamination Site
Project Schedule

ID		Task Name	Subtask	Start	Finish
67		Disposal of Field Generated Waste	3.8	Fri 12/21/07	Thu 1/31/08
68		Demobilization (Interim)	3.2	Wed 10/24/07	Wed 10/24/07
69		**Stage II (if applicable)**		**Tue 2/19/08**	**Tue 6/24/08**
70		Mobilization	3.2	Tue 2/19/08	Tue 2/19/08
71		Borehole Drilling and Coring	3.3	Wed 2/20/08	Wed 3/12/08
72		Borehole Logging	3.3	Wed 2/27/08	Tue 3/4/08
73		Packer Sampling	3.3	Wed 3/5/08	Mon 3/10/08
74		Multiport Monitoring Well Installation and Development	3.3	Tue 3/11/08	Thu 3/20/08
75		Multiport Monitoring Well Sampling - Round 2	3.5	Fri 3/21/08	Wed 4/2/08
76		Multiport Monitoring Well Sampling - Round 3	3.5	Thu 5/1/08	Tue 5/13/08
77		Groundwater/Surface Water Interaction Evaluation	3.3	Wed 2/20/08	Tue 2/26/08
78		Surface Water and Sediment Sampling	3.5	Wed 2/27/08	Fri 2/29/08
79		3.6 Ecological Characterization	3.6	Mon 3/3/08	Tue 3/4/08
80		Disposal of Field Generated Waste	3.8	Wed 5/14/08	Tue 6/24/08
81		Demobilization (Final)	3.2	Wed 5/14/08	Tue 5/20/08
82		**TASK 4 Sample Analysis**		**Thu 4/19/07**	**Fri 6/20/08**
83		4.2 Analytical Services Provided Via CLP, DESA or ERTC	4.2	Thu 4/19/07	Fri 6/20/08
84		Stage I		Thu 4/19/07	Wed 11/28/07
85		Stage II		Mon 3/3/08	Fri 6/20/08
86		4.3 Non-Routine Analytical Services (Subcontracted Analytical Services)	4.3	Tue 4/24/07	Fri 6/20/08
87		Stage I		Tue 4/24/07	Wed 11/28/07
88		Stage II		Tue 3/11/08	Fri 6/20/08
89		**TASK 5 Analytical Support & Data Validation**		**Tue 4/3/07**	**Tue 8/5/08**
90		5.1 Collect, Prepare and Ship Samples (Under Task 3)	5.1		
91		5.2 Sample Management	5.2	Tue 4/3/07	Tue 5/27/08
92		Stage I		Tue 4/3/07	Mon 10/29/07
93		Stage II		Wed 3/5/08	Tue 5/27/08
94		5.3 Data Validation	5.3	Tue 12/11/07	Tue 8/5/08
95		Stage I		Tue 12/11/07	Mon 1/7/08
96		Stage II		Wed 7/9/08	Tue 8/5/08
97		**TASK 6 Data Evaluation**		**Thu 6/14/07**	**Tue 9/9/08**
98		6.1 Data Usability Evaluation	6.1	Tue 1/8/08	Tue 9/2/08
99		Stage I		Tue 1/8/08	Mon 1/28/08
100		Stage II		Wed 8/6/08	Tue 9/2/08
101		6.2 Data Reduction, Tabulation, and Evaluation	6.2	Tue 12/25/07	Tue 8/19/08
102		Stage I		Tue 12/25/07	Mon 1/21/08
103		Stage II		Wed 7/23/08	Tue 8/19/08
104		6.4 Technical Memorandum	6.4	Thu 6/14/07	Tue 9/9/08
105		Stage Ia Technical Evaluation/Presentation		Thu 6/14/07	Wed 8/1/07
106		Stage Ib Technical Memorandum		Tue 1/8/08	Mon 2/4/08
107		Data Evaluation Summary Report		Wed 8/13/08	Tue 9/9/08
108		**TASK 7 Assessment of Risk**		**Wed 8/20/08**	**Tue 11/18/08**
109		7.1 Baseline Risk Assessment (Human Health)	7.1	Wed 8/20/08	Tue 11/18/08
110		Prepare Draft Risk Assessment (HH)		Wed 8/20/08	Tue 9/30/08
111		EPA Review of Draft Risk Assessment (HH)		Wed 10/1/08	Tue 10/28/08
112		Prepare Final Risk Assessment (HH)		Wed 10/29/08	Tue 11/18/08
113		7.2 Ecological Risk Assessment (Screening Level)	7.2	Wed 8/20/08	Tue 11/18/08
114		Prepare Draft Ecological Risk Assessment		Wed 8/20/08	Tue 9/30/08
115		EPA Review of Draft Ecological Risk Assessment		Wed 10/1/08	Tue 10/21/08
116		Prepare Final Ecological Risk Assessment		Wed 10/22/08	Tue 11/18/08
117		**TASK 8 Treatability Study and Pilot Testing**		**Wed 1/21/09**	**Tue 2/17/09**
118		8.1 Literature Search	8.1	Wed 1/21/09	Tue 2/17/09
119		**TASK 9 Remedial Investigation Report**		**Wed 8/20/08**	**Tue 1/20/09**
120		Prepare Draft RI Report	9.1	Wed 8/20/08	Tue 11/11/08
121		EPA Review of Draft RI Report		Wed 11/12/08	Tue 12/23/08
122		Prepare Final RI Report	9.2	Wed 12/24/08	Tue 1/20/09
123		**TASK 10 Remedial Alternative Screening**		**Wed 1/7/09**	**Tue 2/3/09**
124		Technical Memorandum	10.1	Wed 1/7/09	Tue 2/3/09
125		**TASK 11 Remedial Alternative Evaluation**		**Wed 2/4/09**	**Tue 3/3/09**
126		Technical Memorandum	11.1	Wed 2/4/09	Tue 3/3/09
127		**TASK 12 Feasibility Study Report**		**Wed 3/4/09**	**Tue 6/9/09**
128		Prepare Draft FS Report	12.1	Wed 3/4/09	Tue 4/14/09
129		EPA Review of FS Report		Wed 4/15/09	Tue 5/12/09
130		Prepare Final FS Report	12.2	Wed 5/13/09	Tue 6/9/09
131		TASK 16 Work Assignment Closeout		Wed 7/8/09	Thu 7/16/09

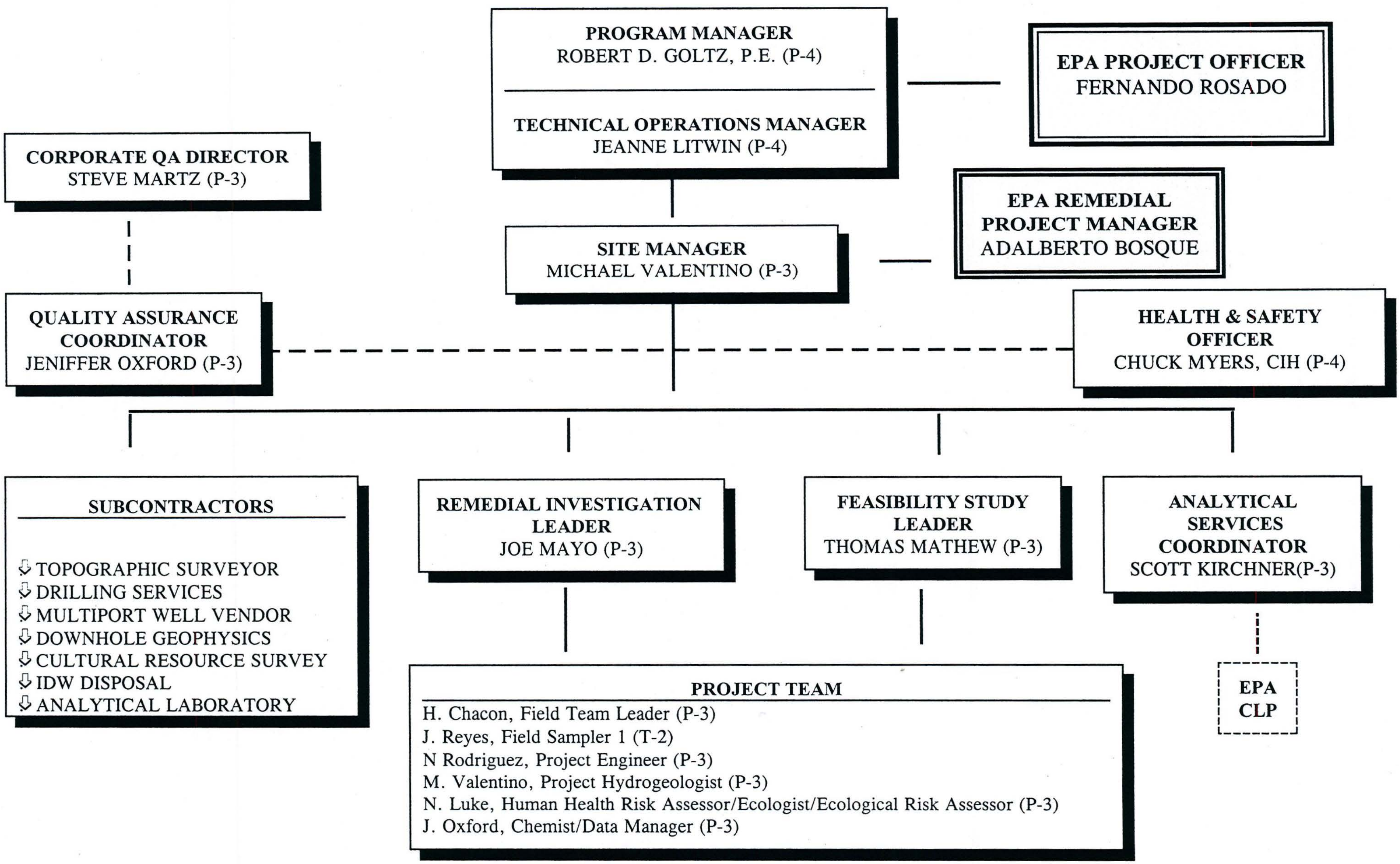


Project: 168Figschedule
Date: Wed 12/27/06

Task Split Progress Milestone Summary

R2-0004980

FIGURE 7-1
PROJECT ORGANIZATION
Cidra Groundwater Contamination Site
Cidra, Puerto Rico



Appendix A

Previous Investigation Soil Sampling Location Maps

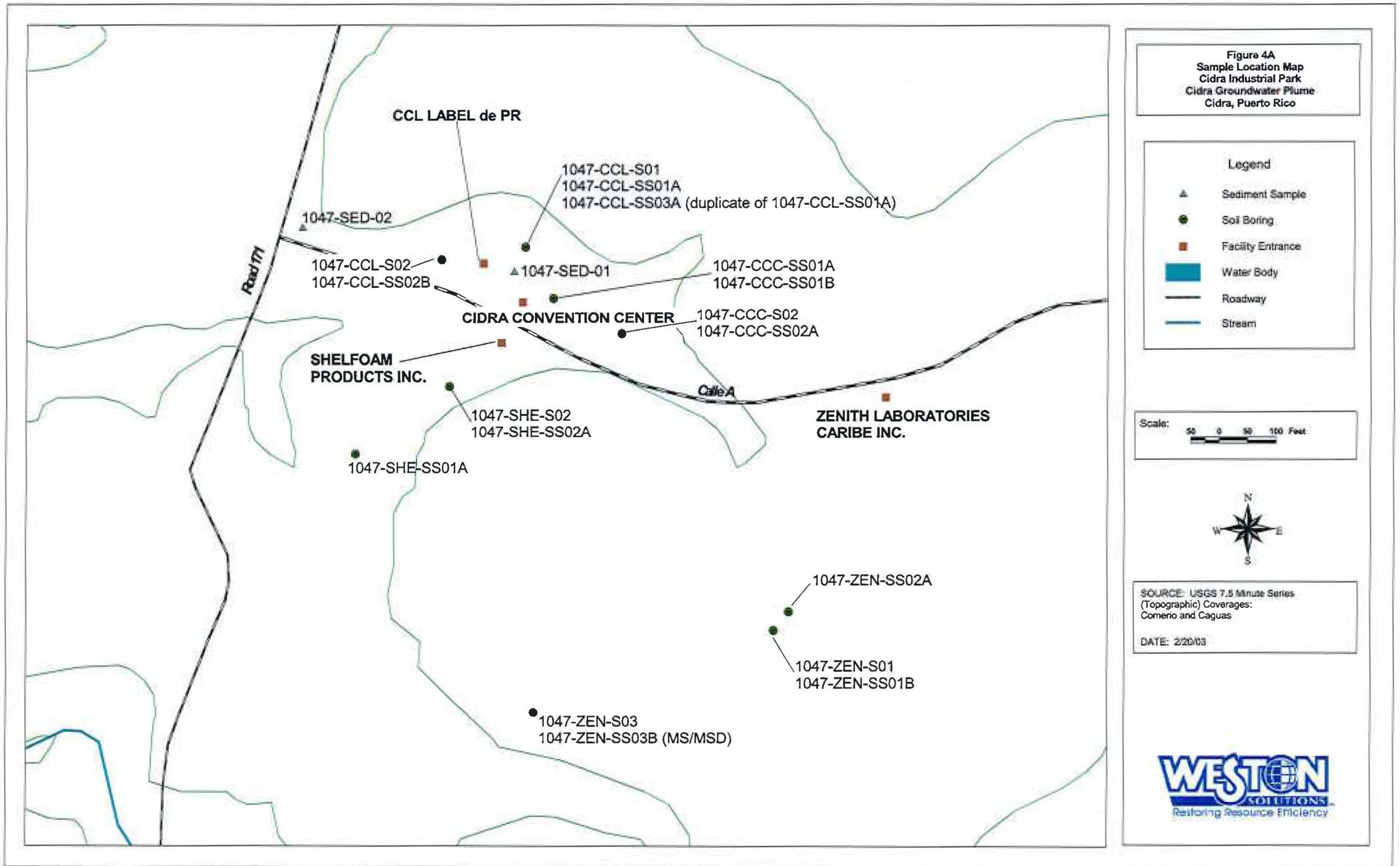


Figure 4A
Sample Location Map
Cidra Industrial Park
Cidra Groundwater Plume
Cidra, Puerto Rico
Legend
Sediment Sample
Soil Boring
Facility Entrance
Water Body
Roadway
Stream
Scale:
50 0 50 100 Feet
N
W
E
S
SOURCE: USGS 7.5 Minute Series (Topographic) Coverages: Comerio and Caguas
DATE: 2/20/03
WESTON SOLUTIONS
Restoring Resource Efficiency
CCL LABEL de PR
1047-CCL-S01
1047-CCL-SS01A
1047-CCL-SS03A (duplicate of 1047-CCL-SS01A)
1047-SED-02
Road 171
1047-CCL-S02
1047-CCL-SS02B
1047-SED-01
1047-CCC-SS01A
1047-CCC-SS01B
CIDRA CONVENTION CENTER
1047-CCC-S02
1047-CCC-SS02A
SHELFOAM PRODUCTS INC.
Calle A
ZENITH LABORATORIES CARIBE INC.
1047-SHE-S02
1047-SHE-SS02A
1047-SHE-SS01A
1047-ZEN-SS02A
1047-ZEN-S01
1047-ZEN-SS01B
1047-ZEN-S03
1047-ZEN-SS03B (MS/MSD)

R2-0004983

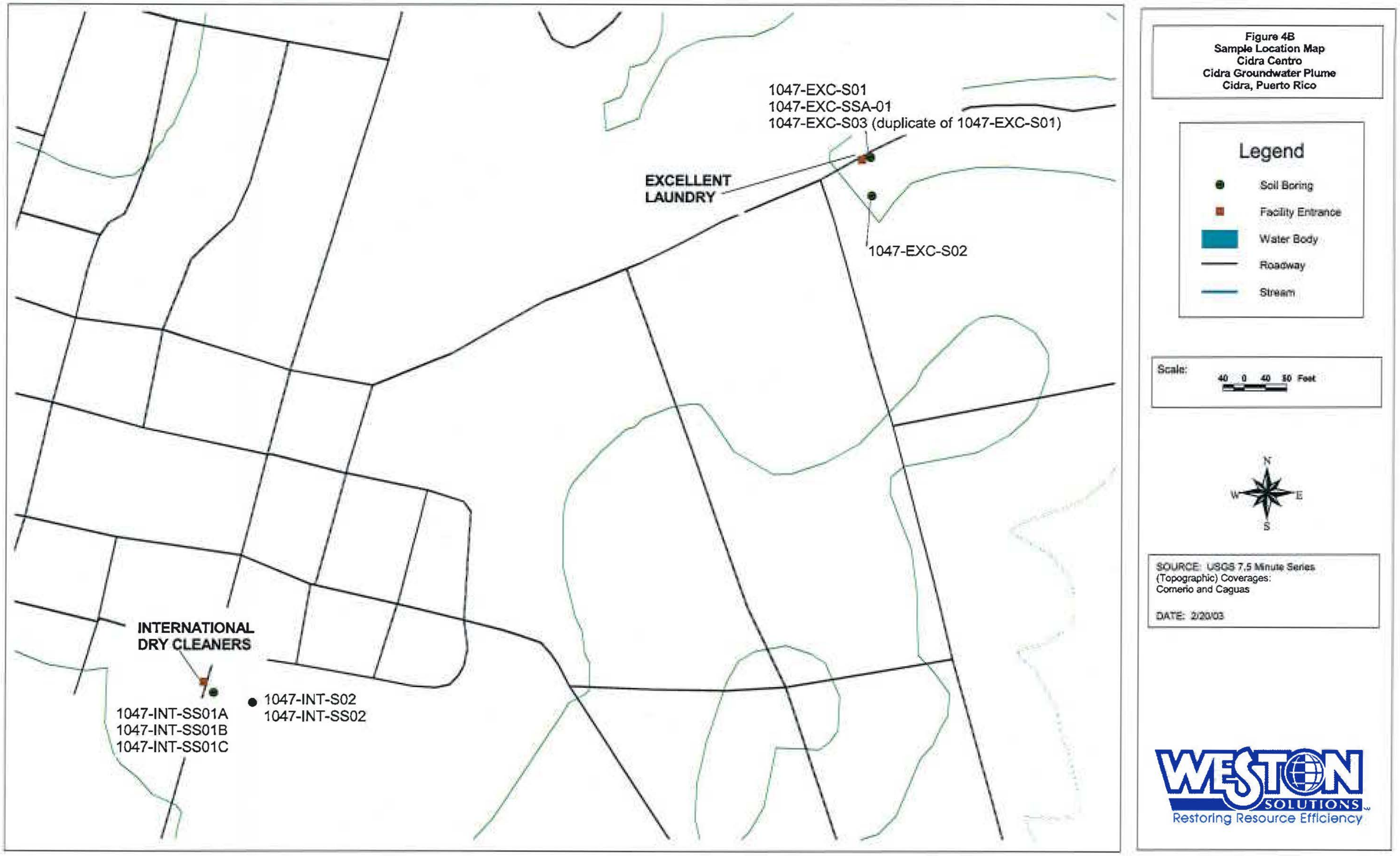


Figure 4B
Sample Location Map
Cidra Centro
Cidra Groundwater Plume
Cidra, Puerto Rico

SOURCE: USGS 7.5 Minute Series (Topographic) Coverages: Comerio and Caguas

DATE: 2/20/03

R2-0004984

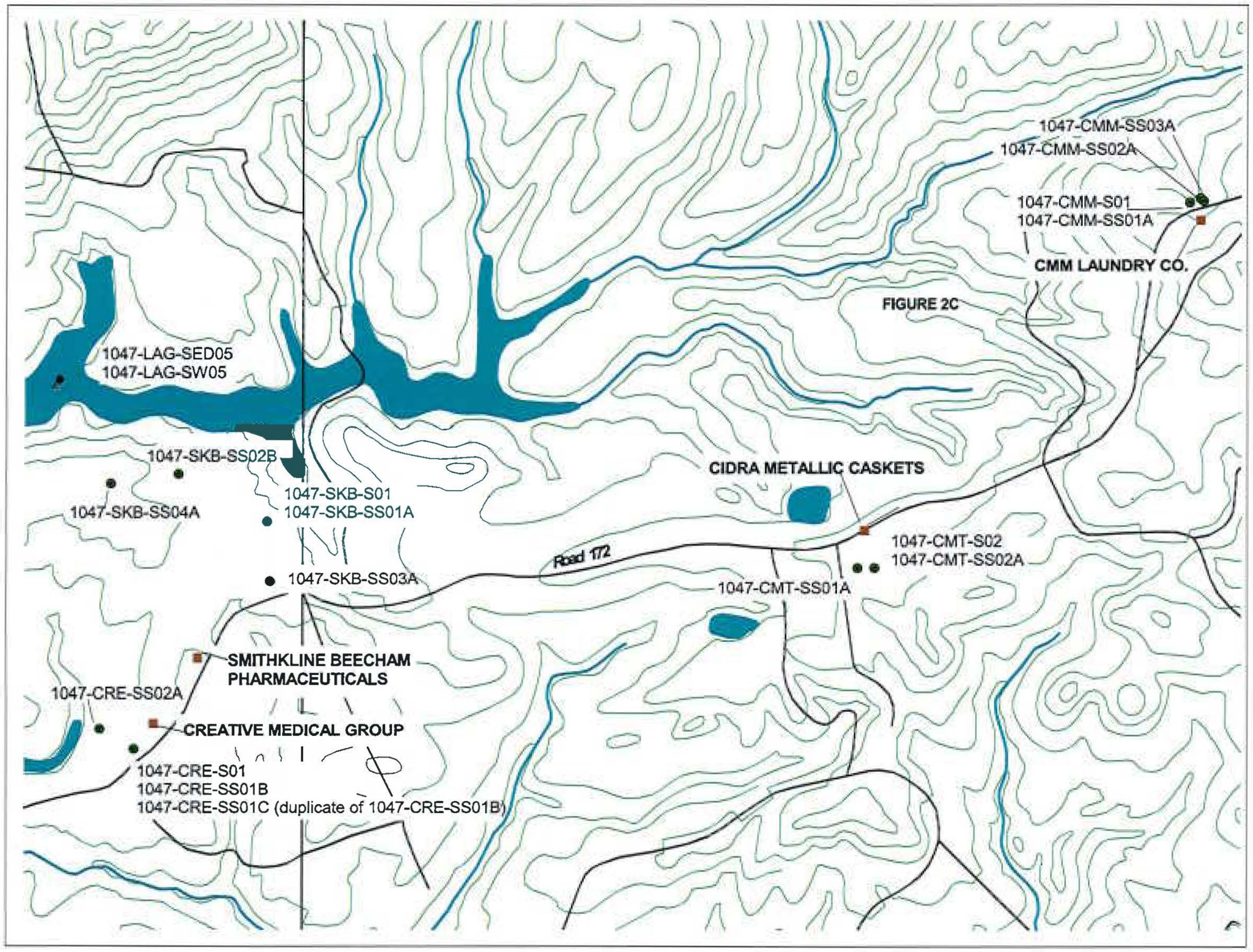


Figure 4C
Sample Location Map
Road 172, Cidra & Caguas
Cidra Groundwater Plume
Cidra, Puerto Rico

Legend

- Sediment Sample
- Soil Boring
- Surface Water Sample
- Facility Entrance
- Water Body
- Roadway
- Stream

Scale: 200 0 200 400 Feet

N
W E
S

SOURCE: USGS 7.5 Minute Series (Topographic) Coverages: Comerio and Caguas

DATE: 2/20/03

WESTON SOLUTIONS
Restoring Resource Efficiency

R2-0004985

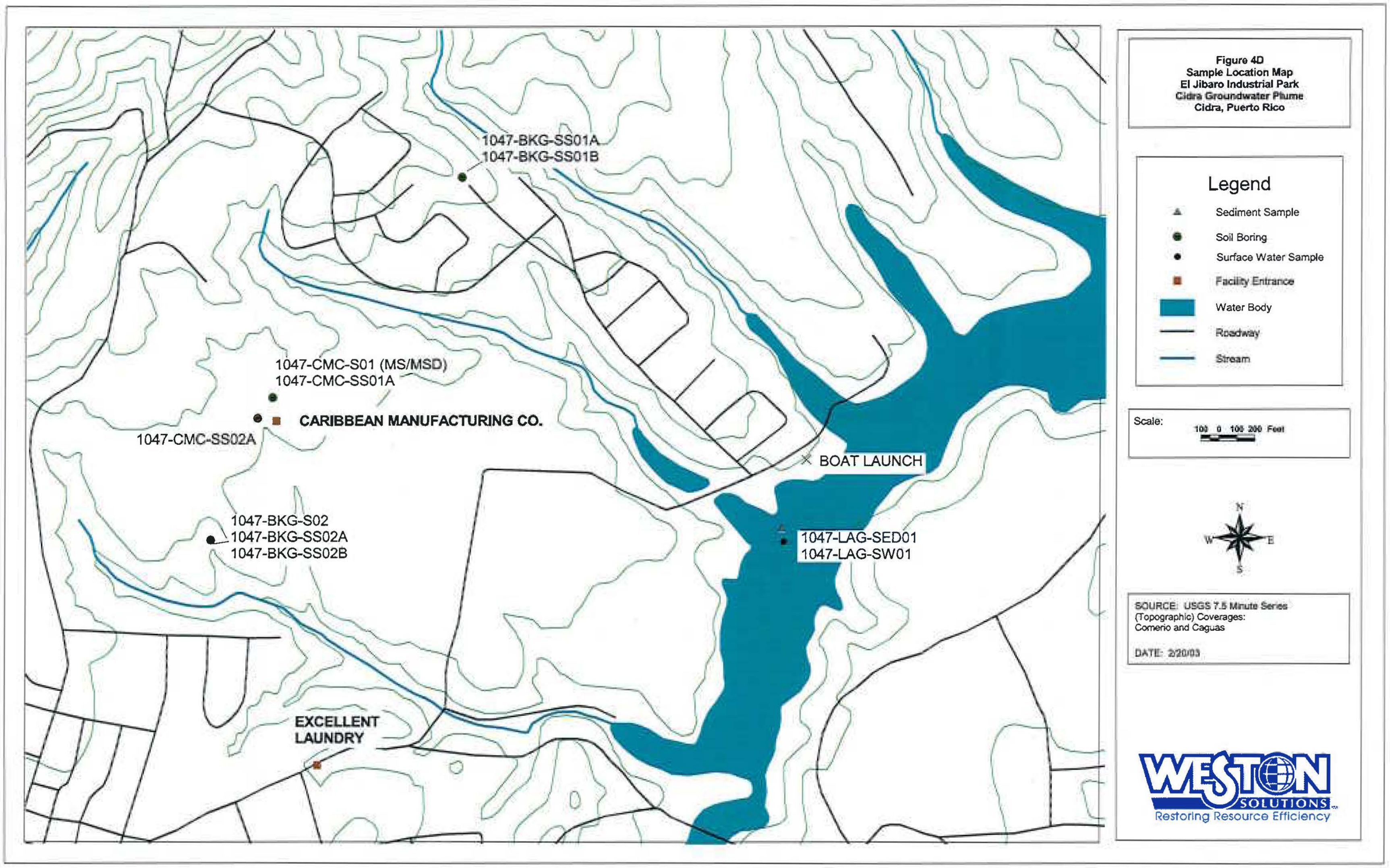


Figure 4D
Sample Location Map
El Jibaro Industrial Park
Cidra Groundwater Plume
Cidra, Puerto Rico
Legend
Sediment Sample
Soil Boring
Surface Water Sample
Facility Entrance
Water Body
Roadway
Stream
Scale:
100 0 100 200 Feet
N
W
E
S
SOURCE: USGS 7.5 Minute Series (Topographic) Coverages: Comerio and Caguas
DATE: 2/20/03
WESTON SOLUTIONS
Restoring Resource Efficiency
1047-BKG-SS01A
1047-BKG-SS01B
1047-CMC-S01 (MS/MSD)
1047-CMC-SS01A
CARIBBEAN MANUFACTURING CO.
1047-CMC-SS02A
BOAT LAUNCH
1047-BKG-S02
1047-BKG-SS02A
1047-BKG-SS02B
1047-LAG-SED01
1047-LAG-SW01
EXCELLENT LAUNDRY

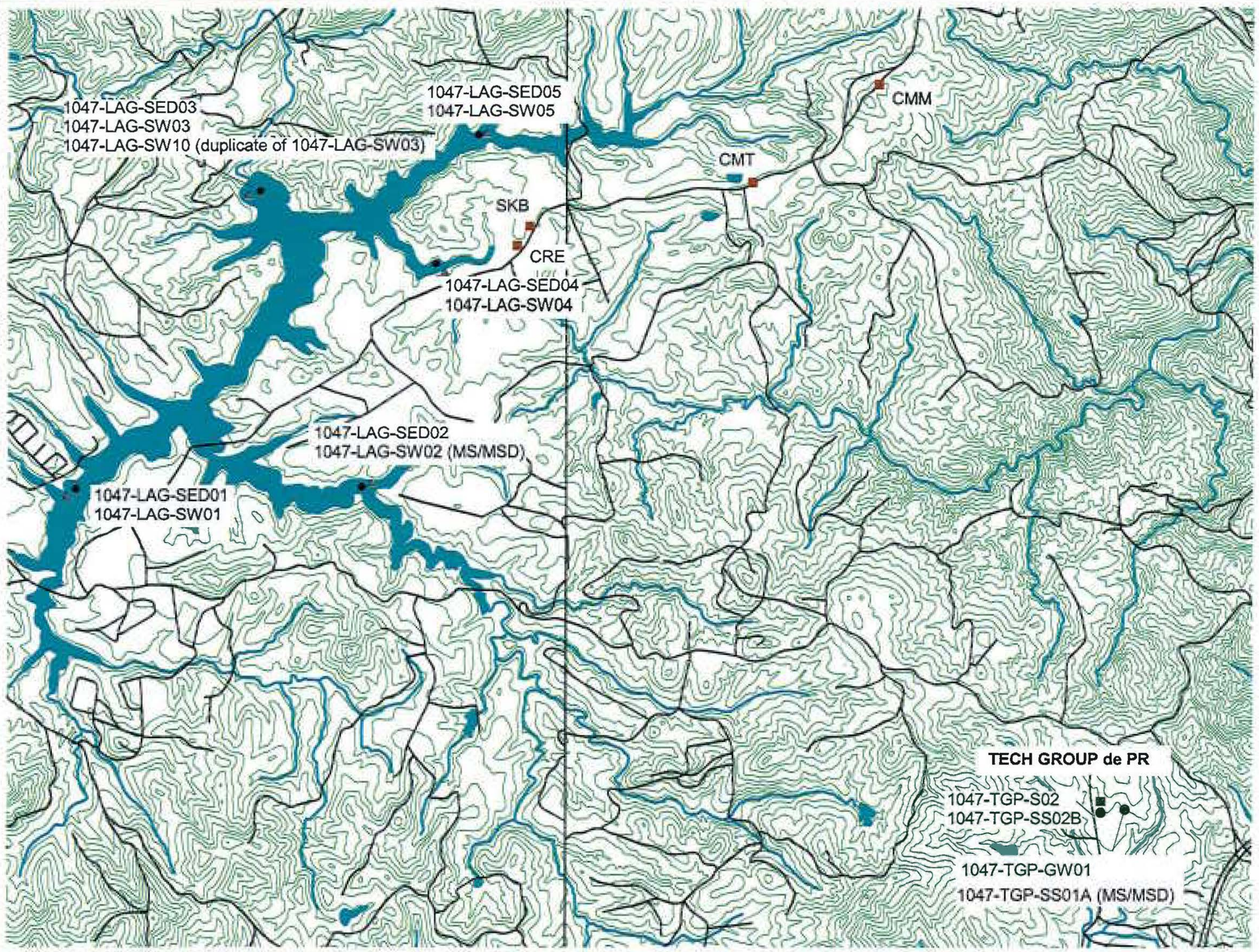


Figure 4E
Sample Location Map
Lago de Cidra
Cidra Groundwater Plume
Cidra, Puerto Rico

Legend

- Sediment Sample
- Soil Boring
- Surface Water Sample
- Facility Entrance
- Water Body
- Roadway
- Stream

Scale: 500 0 500 1000 Feet

N W E S

SOURCE: USGS 7.5 Minute Series (Topographic) Coverages: Comerio and Caguas

DATE: 2/20/03

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